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MINISTRY OF AGRICULTURE, FEDERATION OF MALAYA.
Kuala Lumpur.

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THE MALAYAN AGRICULTURAL JOURNAL

The Journal is designed to present—as far as possible in non-technical terms—the results of the agricultural research, investigation and extension work in Malaya performed by the Department of Agriculture. Also, by means of selected articles, abstracts and reviews, this publication draws attention to the results of work of a similar nature in other countries, which have a bearing on agriculture in Malaya.

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THE

Malayan Agricultural Journal

Vol. 39, No. 3, 1956.

EDITORIAL

The Search for Padi Land. That this issue of the Journal is the second in succession to contain the report of a soil survey is in itself an indication of the efforts the Department of Agriculture is making to ensure that undeveloped land is not opened up for planting with crops that will not grow well on it. The first article in this issue of the Journal again deals with the soil survey of an area which it was thought might be suitable for the cultivation of padi. The area in question is the Kuala Langat (North) Forest Reserve in Selangor.

The surveyors' findings are disappointing in that they estimate that nearly 80 per cent (39,000 acres) of the area is covered by peat and that a further 7,000 acres is hilly land. Most of the peat is deep (35,000 acres deeper than 5 ft.) and therefore quite unsuitable for the growing of padi.

The Control of Weeds in Padi Fields. The second article in this issue gives an account of some observation trials in which herbicides were used to control weeds in padi fields. The trials were carried out in a small area in Kedah in which the padi was, by way of experiment, cultivated with the aid of machines, all operations from preparation of the land to harvesting the crop being mechanised.

The trials provided no firm conclusions but did indicate that the use of herbicides exercised a high degree of control over the weed growth. Five different herbicides were used and each of them was equally effective. Applications were made by means of liquid sprays and by dusting, the latter being the more difficult to carry out because of the considerable drift brought about by even a slight breeze.

Another Census of Agricultural Machinery. The first census of mechanical field equipment in use on estates in Malaya was taken in 1949, and a report on it was published in this Journal. At that time it was considered that a census should be carried out every year, but the second attempt, in 1950, to assess the amount of equipment in use was a failure, only 46 per cent of the questionnaires sent to estates being

returned for analysis. A third and wider census was carried out in December, 1954, and a report on it is included in this number of the Journal.

The census was carried out in three parts: a census of mechanical equipment used (1) on estates, (2) by Government or quasi-Government contracting services, and (3) by smallholders and small contractors. The last part of the census was a failure, for whereas it is estimated that over 200 tractors are used by smallholders, details of only 36 of them were listed in the questionnaires returned.

The remaining parts of the census are considered to have served their purpose. Approximately 83.8 per cent of all estates completed and returned the questionnaire, and of these estates 396 were using agricultural machinery compared with 186 in 1949.

It is proposed now to hold a census of mechanical field equipment every five years.

Growing Cauliflowers in the Highlands. A short article in later pages gives an account of the cauliflower industry at Cameron Highlands and includes a comparison of yields and head weights for six imported varieties tested by the Department of Agriculture in 1955.

SOIL SURVEY REPORTS. NO. 4, THE KUALA LANGAT (NORTH) FOREST RESERVE

BY

J. K. COULTER,

Senior Soils Chemist.

Introduction

This survey was carried out as part of the general policy of surveying land which, from a topographical point of view, would probably be suitable for padi. The area in question, which is situated in South Selangor, is bounded by the Klang to Telok Datoh road to the west and south-west, the Telok Datoh to Dengkil road to the south and the Dengkil to Puchong road to the east and north east; it covers the Kuala Langat (North) Forest Reserve, the Tanjong Duablas Malay Reserve and the Telok Forest Reserve.

For many years the area has been regarded as potential padi land though it was known that there was peat in parts and also some hilly land, e.g. Bukit Cheeding. The extent of the peat was unknown.

The surveyed area measured approximately 49,000 acres, and of this 39,000 acres proved to be peat and 7,000 acres hilly ground.

Method of Survey

The survey was carried out in a manner similar to that used in the Trans-Perak survey (1). The Survey Department was responsible for taking the levels and its parties also took the soil samples. North-south lines, spaced at 1,000 yd. intervals, were cut through the jungle and soil samples were taken along these lines. Since eight to 10 teams were working in the area it was impossible to have experienced soil surveyors with them, and the system was adopted of taking soil samples and peat depth measurements at regular intervals. This sampling was necessary in order to check that it was peat and not just clay mixed with some organic matter that was being examined. Peat depth measurements were taken at 600 ft. intervals along the lines by means of a Hiller-type auger. With this instrument it is possible to measure peat depths with considerable accuracy. Depths were measured down to 10 ft.; where the depth was greater than this it was recorded as being over 10 ft., though in a few areas depths greater than this were actually measured and in one case reached 13 ft. At alternate posts, i.e. every 1,200 ft., soil samples were taken with a 6 in. diameter auger. Sampling depths were 0-9 in. and 9-18 in., and where the peat was less than 5 ft. in depth a sample of the underlying clay was also obtained. The soil map was made from the records of peat depth measurements.

The soil samples were brought to the laboratory and mechanical analyses, loss on ignition, pH, conductivity, "readily soluble" phosphorus and potassium and soluble salts were determined by the methods outlined in the report of the Trans-Perak survey (1).

During the course of the survey, records were made of the type of vegetation and the depth of water if the area was flooded.

General Description of the Area

Topography

With the exception of four small hills, Mengkuang, Mandul, Cheeding and Jerampang, the area is generally very flat. The greatest height is 165 ft. at Bukit Cheeding but the greater proportion of the area lies between 20 and 30 ft. above sea level. The levels show a gradual increase in height from west to east and they also tend to increase from the south towards the centre and then decrease as one goes further north. The area can thus be regarded as dome shaped. The significance of this will be discussed later.

Drainage

An interesting feature of the area is that there are considerable parts of it which, though covered with deep peat, are dry on the surface. This again is believed to be associated with the dome-shaped surface of the peat. There are however large parts of the area which are wet on the surface. Only one small stream, the Sungei Sidu, flows out of the area.

Vegetation

Most of the area is covered with primary jungle, though the Forest Department states that a fairly large proportion has been exploited for timber. This may account for the fact that examination of aerial photographs suggests that the jungle is rather poor, especially to the south and east of Bukit Cheeding, where it appears to consist mostly of small trees. Notes taken on the vegetation during the traverses show that *meranti* (*Shorea* spp). *mengkuang* (*Pandanus* spp.), *bertam* (*Eugeissona tristis*) and *keranji* (*Dialium* spp). are of common occurrence.

Soils

During the course of the survey, 1,361 samples were taken and of these 1,048, or 77 per cent, were classified as peats and mucks. From the map showing peat depths, the acreages of peat of different depths have been estimated and these are given in Table I. It should be noted that a good deal of the peat marked as being 5 to 10 ft. in depth is usually over 8 ft., so that the average depth is actually greater than might be supposed from the map.

Table I.

Acreages of Peat of Different Depths.

Depth	Acres
Peats and mucks over 10 ft. deep	9,050
between 5 and 10 ft.	25,750
„ 3 and 5 ft.	3,000
less than 3 ft.	1,200

After allowance has been made for the hilly land, the acreage of non-peaty soils is so small that it is of no significance as far as a padi scheme is concerned.

Description of Soils

The standard definition for peats and mucks has been retained, i.e. mucks:—loss on ignition between 35 and 65 per cent, and peats:—loss on ignition greater than 65 per cent (ignition at 800°C for four hours).

The peat is formed in a manner similar to that in other parts of Malaya and is mainly forest peat built up from forest debris from previous and existing swamp forest. Sedges and ferns also contribute to some extent to the material. The build-up of the peat in the Kuala Langat area presents some interesting features, and the shape of a cross section is given in Figure I. It would appear that the area started as a swamp with water draining into it from outside sources and that the resulting waterlogged and anaerobic conditions gave rise to the initial peat formation. The depth of peat gradually increased and the amount of water flowing into the area decreased, so that more and more of the water entering the area was made up of direct rainfall. As no mineral matter is brought in by rainfall, the acidity has increased and, through time, it is acidity rather than waterlogging which has inhibited the decay of the organic matter. A similar type of build-up occurs in the coastal areas of Borneo, and in these the tree growth is very poor. In the Kuala Langat area the tree growth has not deteriorated to such a poor state but it would appear that the peat in the area bears a fairly close resemblance to the ombrogenous peats of Indonesia (3).

RESULTS OF ANALYSES

Loss on Ignition

The results are expressed in histogram form in Figure II. This shows the large proportion of samples with a high loss on ignition, 66.8 per cent of all the samples having a loss on ignition of over 80 per cent, which is a much higher figure than that found in the Trans-Perak area.

Acidity

A marked feature of the peats in this area is their acidity, and the results of the analyses are shown in Figure III. Approximately 36 per cent of the samples have pH values below 3.6. The corresponding percentage for Trans-Perak is 7.8. It is difficult to assess the implications, from an agricultural point of view, of the high acidity of this peat. As far as is known, the acidity of the peat does not appear to make any difference to those crops, e.g. pineapples, which are suited to peat.

"Readily Soluble" Phosphorus and Potassium

There is a fairly wide distribution of values for "readily soluble" phosphorus but the greater proportion of samples have values of the order of 30 p.p.m. P, though there are considerable numbers with values up to 100 p.p.m. P (Fig. IV). These values are somewhat higher than those found for other peat areas. For "readily soluble" potassium, there is a wide variation in values from 25 p.p.m. to over 400 p.p.m. K but these values are lower than those of other peat areas, though they are still very high when compared with mineral soils (Fig. V). It is suspected that in peat soils much of the potassium is soluble in N/2 acetic acid whereas in minerals soils only a small proportion is soluble. Thus, although the initial figures are high, the reserves are probably very low. Some samples were ashed and the ash analysed for calcium, magnesium and potassium, and the results are given in Table II.

Table II.

Analyses of Ash of Peat Samples.

Ash.	Percentage in Ash.			Percentage on Dry Matter.			Available K Per Cent Dry Matter.
	K	Ca	Mg	K	Ca	Mg	
6.6	1.021	3.618	0.905	0.068	0.240	0.060	0.012
7.5	0.523	6.056	0.941	0.039	0.455	0.071	0.013

Conductivity and Soluble Salts

Conductivity measurements were carried out in the usual way as a check on excess chlorides and sulphates. Where the specific conductivity (mhos x 10^{-6}) exceeded 200, water soluble chlorides and sulphates were determined. Only sub-soil samples were analysed, and of the samples examined only eight contained any appreciable quantity of sulphates; the highest amount recorded was 1.43 per cent. It was noted that none of the peat samples contained any sulphates, which were present only in the underlying clay. Owing to the depth of the peat,

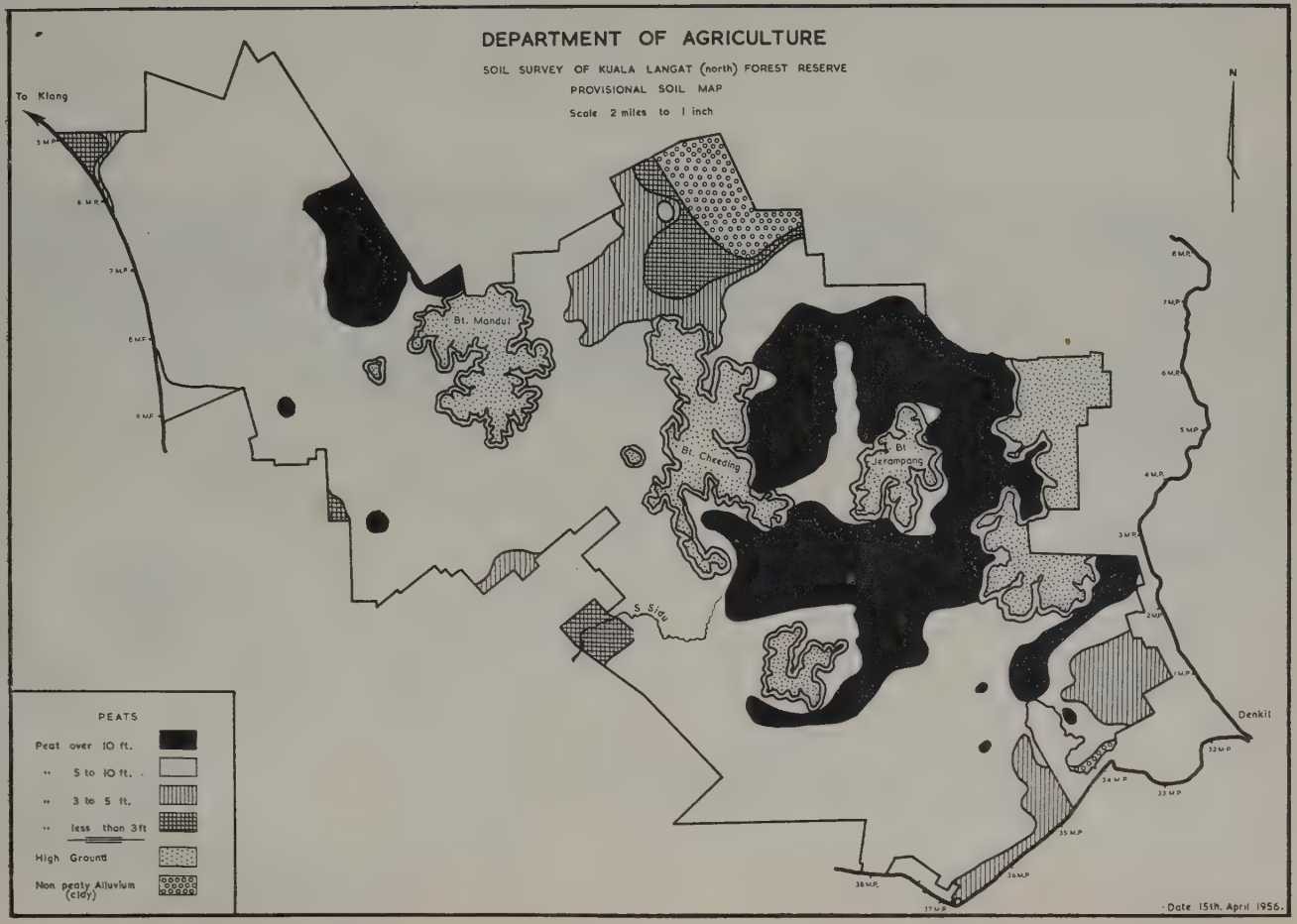

DEPARTMENT OF AGRICULTURE
SOIL SURVEY OF KUALA LANGAT (north) FOREST RESERVE
PROVISIONAL SOIL MAP
Scale 2 miles to 1 inch
N
To Klang
5 M.P.
6 M.P.
7 M.P.
8 M.P.
9 M.P.
Bt. Mandul
Bt. Cheeding
Bt. Jerampang
S. Sidu
8 M.P.
7 M.P.
6 M.P.
5 M.P.
4 M.P.
3 M.P.
2 M.P.
1 M.P.
Denkil
32 M.P.
34 M.P.
33 M.P.
35 M.P.
36 M.P.
38 M.P.
17 M.P.
PEATS
Peat over 10 ft.
" 5 to 10 ft.
" 3 to 5 ft.
" less than 3ft
High Ground
Non peaty Alluvium (clay)
Date 15th. April 1956.

Fig. I. (Line F).

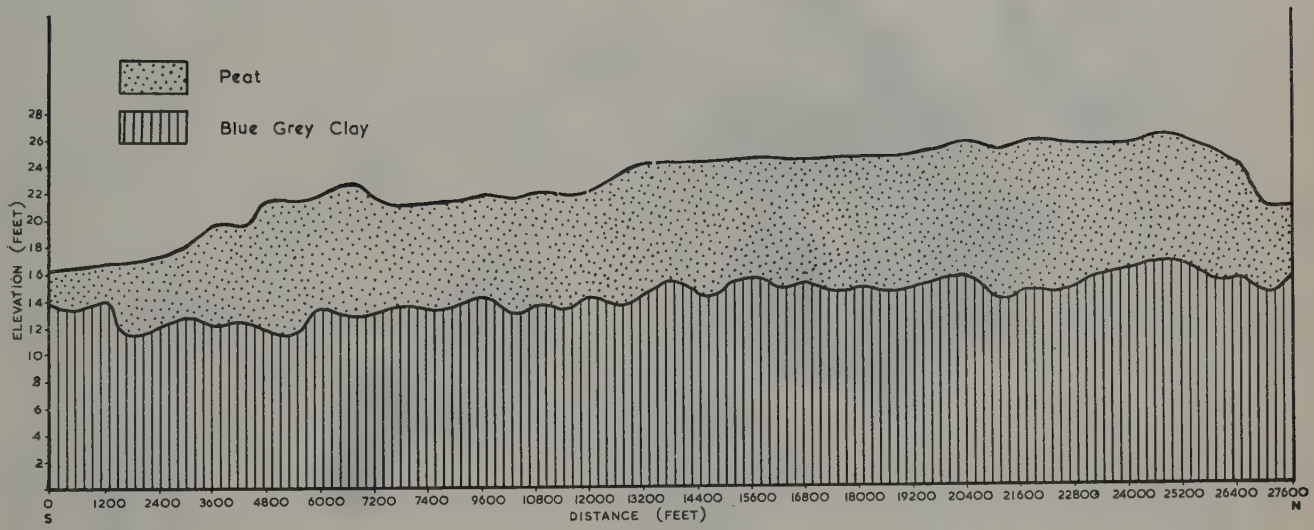

Peat
Blue Grey Clay
ELEVATION (FEET)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
S
1200
2400
3600
4800
6000
7200
7400
9600
10800
12000
13200
14400
15600
16800
18000
19200
20400
21600
22800
24000
25200
26400
27600
N
DISTANCE (FEET)

Fig. II.

Loss on Ignition of Peat and Mucks.

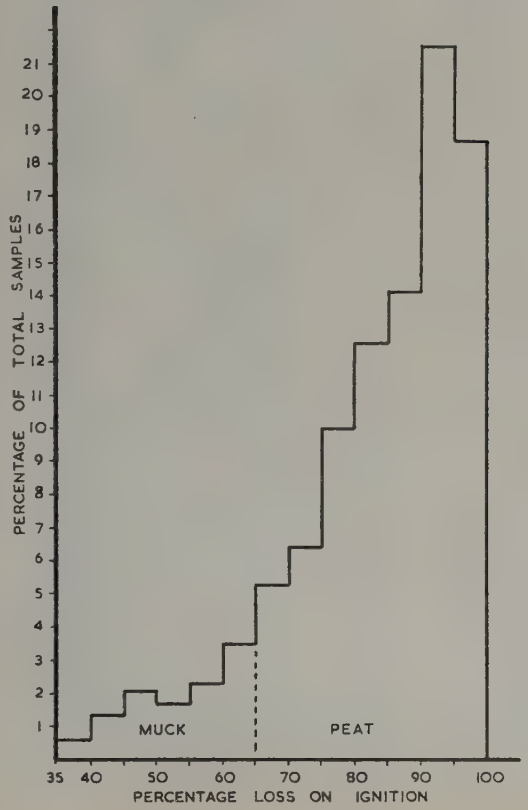


Fig. III.

pH of Mucks and Peats.

Fig. IV.

Available Phosphorus Content of Peats and Mucks (Top soil only).

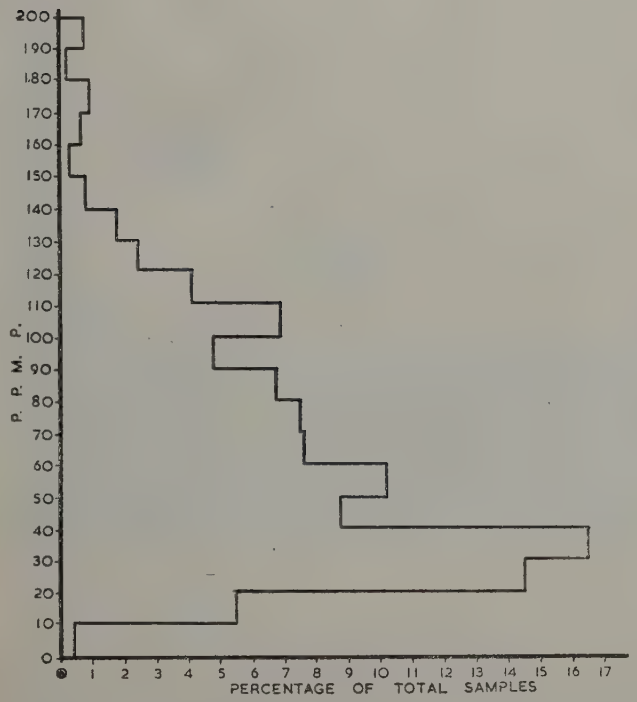
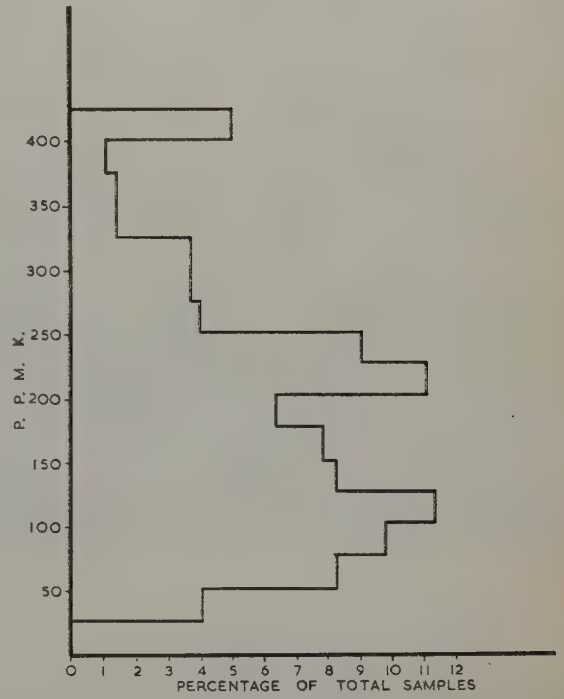


Fig. V.

Available Potassium Content of Peats and Mucks (Top soil only).



samples of the underlying clay were only obtained in a few areas, but since all these contained sulphates it is probable that much of the clay does contain them. Such is rather to be expected as the underlying clay has been laid down under marine conditions and has not been drained, so the sulphates from the sea water have never been leached out. In the event of all the peat disappearing, drainage of the underlying clay would remove the sulphates.

Agricultural Development of the Area

With such a high proportion of deep peat, development of the area for padi is out of the question and any potential crop would have to be suitable for deep peat; pineapples are thus an obvious choice. It should be noted that the soils underneath the peat are generally heavy clays and would be quite suitable for several crops. Since the surface of the clay beneath the peat varies from 12 to 20 ft. above sea level, the soil underneath could be used if a way was found of getting rid of the peat and the clay was properly drained.

Now is the time to plan the opening up of these peat areas if one is to look ahead to the period, probably not many years hence, when all the flat land in Malaya will be needed for agriculture. If the area is cleared and dry-land crops are grown, the peat will eventually disappear. Drainage and oxidation aided by liming and burning would help to reduce the levels, but we have no direct evidence as to how long it would take, say, 10 ft. of peat to disappear. Measurements in the Everglades of Florida (admittedly on a different type of peat) showed that the initial shrinkage was very rapid after drainage, being about 2½ ft. in five years (2). Thereafter the rate of shrinkage was slower and was largely the result of oxidation. This oxidation is biochemical and might be slower in Malaya because of the more acid conditions. The shrinkage rate is of the order of one inch per year but is influenced by the height of the water-table. Workers in Florida have put forward the following formula:—

$$x = \frac{y - 2.45}{14.77}$$

in which x is the subsidence rate in inches per year and y is the average depth of water-table in inches, to give a measure of the rate of shrinkage (2).

The rate of subsidence in Malaya would probably be a little slower than this if timbers were not removed but decidedly faster if they were removed. Using the formula given above, it can be calculated that, if the water-table were kept at 30 in. below the surface, it would take approximately 50 years for 10 ft. of peat to disappear. It should be noted however that burning, as is often practised on these soils, would lower the levels at a faster rate. It is quite possible that, with manuring, liming and burning, these peat soils will become valuable agricultural land for crops other than pineapples in 10 to 20 years, by which time the demand for flat land for annual crops will be quite considerable.

Conclusion

The soil survey shows such a large proportion of deep peat that the use of the area for padi is not feasible. The survey has given further evidence that much of the flat land of the west coast of Malaya between the cultivated alluvium at the seaward side and the foot-hills is deep peat. Thus the prospects of finding further large areas of alluvial soils on the west coast suitable for padi are very slender.

Acknowledgement

Acknowledgement is made to the Survey Department whose officers collected the samples, measured the peat depths and provided the base maps.

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OBSERVATIONS ON THE CONTROL OF WEEDS IN PADI FIELDS BY THE USE OF HERBICIDES

BY

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Introduction

Since the inception of investigations into the complete mechanisation of wet padi cultivation in Malaya, considerable success has been achieved in evolving satisfactory methods of land preparation and advances have been made in the direction of introducing the crop to the land and of harvesting it (1, 2, 3, 4, 5 and 6). The problem of weed control has, however, received scant attention and it was decided, therefore, to lay down observation plots to study the effects of certain herbicides on the padi land flora of the North Kedah Plain during the 1954-55 padi season.

Although it was incidental to the observations under review, it was decided to integrate these herbicide trials into a system of complete mechanisation of padi cultivation, and the area used for these trials did in fact become the first area of padi land in Malaya to be cultivated mechanically from start to finish, i.e. from land preparation to harvest. Since, however, the area involved amounted to only seven acres, it would be wrong to regard this as a Pilot Scheme and rash to apply the results of timings and costings to larger areas: rather should this essay at complete mechanisation be regarded as the application throughout a complete season of a series of methods previously only employed severally over a number of seasons and in a variety of places.

An account will therefore be given of all the operations involved in growing this crop of padi, although emphasis will be placed on the aspect of weed control.

The Site

The site chosen for these trials was a long, narrow strip located along the eastern border of Telok Chengai Padi Experiment Station, Kedah, and measured some 1,300 ft. in length with an average width of 235 ft., giving an area of 6.93 acres. The strip was divided by broad-based bunds into eight plots, varying in size from 0.61 to 1.07 acres each. This same strip had been used the previous season for preliminary trials with the Massey Harris No. 80 S.P. Rice Special Combine and the Opperman Baler (6 and 7), and the usual narrow cross-bunds had been pulled down and converted into low, broad-based levees of the type used in the U.S.A. for mechanised rice growing.

It was not possible to dispense with these cross-bunds entirely as they were found to be necessary for water control, but in their modified form they offered little or no impediment to the progress of mechanical equipment.

Part of the combining trials during the previous season had been carried out under somewhat difficult wet conditions with the result that a number of large ruts had been formed; these however had dried out by the time land preparation was put in hand for the 1954-55 season and caused no difficulty.

The North Kedah Plain is on the fringe of the monsoonal belt and is characterised by a long dry season, associated with the North East Monsoon, from mid-December to mid-March; during this dry spell the alluvial clays of the Plain dry out and become deeply fissured and the extent of the drought is such that very little off-season weed growth occurs.

Land Preparation

Ploughing was carried out in firm, dry conditions between the 8th and 10th February, 1954, using a Ferguson T.E.A. 20 tractor fitted with a 16 in. single-furrow mould-board plough. The furrows ran the length of the strip and the plough was lifted out of work when traversing the cross bunds; the turning-in of the comparatively long stubble left by the combine presented no difficulty, the cut straw having been baled and carted off. Total ploughing time was 24 hr., giving an average of 3 hr. 27 min. per acre.

The land was left fallow until mid-June, by which time the furrow slices had broken down well as a result of alternate wetting and drying; there was, however, a fairly heavy growth of the sedge *Scirpus grossus* (Malay: *menderong*) and volunteer padi, both of which started growing strongly as soon as the dry season broke.

Subsequent after-cultivation would have been more easily and quickly carried-out had it been possible to undertake it earlier; there is, however, a certain minimum requirement of standing water before after-cultivation can be started, and this requirement was not satisfied until the 17th June.

After-cultivation took the form of rolling, using a Ferguson T.E.A.20 tractor mounted on Bombardier half-tracks and pulling a locally-made, 18 in. diameter, 10 ft. long Triple Kedah roller. The average depth of water was 3 to 4 in. and rolling was completed without difficulty in a total of 55 hr., the operation being carried out in two phases. In the first phase, the whole strip was rolled from end to end a total of seven times: in the second phase, each individual plot was rolled until a satisfactory finish had been obtained: this necessitated as many as five additional rollings in the case of the middle plots, but only one more rolling in the end plots where frequent turning had taken place during the first phase. The average time taken to roll an acre was therefore over 7½ hours and, as will be seen from Table I, this represents a high proportion of the

Table I.

Dates of Operations and Working Rates.

Date 1954	Operation	Equipment Used	Machine-Hr. per Acre.	Man-Hr. per Acre.
8th — 10th Feb.	Ploughing	Ferguson TEA-20 tractor and single-furrow mould-board plough	3.45	3.45
17th — 23rd June	Rolling	Ferguson TEA-20 with Bombardier half-tracks and locally-made trailing "Kedah" roll 18 in. dia.	7.58	7.58
19th — 22nd June	Pumping	1½ in. Rapier pump	8.23	2.00 [1]
27th — 28th June	Broadcasting	Bow-operated seed fiddle	0.67	1.67 [2]
27th June—13th July (intermittently)	Pumping	1½ in. Rapier pump	12.70	2.25 [1]
14th — 19th Aug.	Spraying	Various types of experimental sprayers and dusters	3.00 (average)	9.00 (average)
10th — 16th Jan.	Harvesting	Massey-Harris No. 80 self-propelled combine harvester	4.35 [3]	8.70 [3]
		TOTAL	39.98	34.65

NOTES:—

1 Estimated time including setting up and removing pumps and hoses.

2 Estimated time including preparation of seed, etc.

3 Owing to a mechanical breakdown, harvesting was very late and the crop was very badly lodged and tangled. During the previous season, the same plots were harvested in 2.05 machine-hr. and 4.10 man-hr. per acre.

total machine-hours employed and it is probable that a considerable saving might have been effected in the overall cost of cultivation if the off-season vegetation had been sprayed with a herbicide prior to rolling. A satisfactory "finish" was obtained on all plots, though it was found necessary to pump a certain amount of water into some of the higher plots where a shortage tended to cause clogging of the vanes of the roller.

Broadcasting

Thirty *gantangs* (gallons) of dry seed of the variety Subang Intan 117 were put to soak on the morning of the 24th June and, after 48 hours, the soaked seeds were taken out and spread on damp sacking and germinated as follows:—

(a) 19 *gantangs* (soaked seed) for 36 hr., and
(b) 20½ *gantangs* (soaked seed) for 48 hr.

In the late afternoon of the 27th June, the first batch was dried off by mixing with Christmas Island rock phosphate and broadcast in four of the plots; in the early morning of the 28th June, the second batch was similarly dried off and broadcast in the remaining four plots.

Broadcasting was carried out using the same type of fiddle as was used in previous trials (4 and 5), namely a reciprocating disc operated by a "bow", the flow of seed on to the disc being controlled by a shut-off slide.

Owing to the late arrival of the fiddle, and the consequent inability to practice, the operator was less experienced than those employed in previous trials and the speed of work and the evenness of seed distribution were therefore not of such a high order. Details of sowing rates are given in Table II.

Table II.

Seed Rates.

Date 1954	Area of plot (acres)	Volume of soaked seed per plot (gantangs)	Time taken per plot (min.)	Sowing Rate (lb. dry seed per acre)
27th June	0.64	4.375	Not recorded	29.6
„	0.61	3.00	„	21.3
„	1.07	4.25	„	17.2
„	1.07	7.50	„	30.4
28th June	1.07	6.25	45	25.3
„	0.99	4.75	40	20.8
„	0.73	4.50	35	26.7
„	0.75	5.00	40	28.9

PLATE I.

After-cultivation. A Ferguson tractor, on Bombardier half-tracks, pulling a "Triple Kedah" roller.

PLATE II.

Broadcasting with fiddle. Note "finish" obtained by rolling.

PLATE III.

Harvesting. Massey Harris combine working in the laid crop.

PLATE IV.

Spraying selective herbicides. Two Favori-Colibri pressure-retaining knapsack sprayers connected by a 12 ft. boom with six low-volume nozzles.

It was noticed that in the case of the second batch of seed, namely that which had been germinated for 48 hr., the radicles had grown to an average length of slightly more than a quarter of an inch and that many of them were broken or snipped-off during broadcasting. In order to ascertain what effect this damage would have upon subsequent growth, a further small batch of seed was soaked for 48 hours and germinated for 48 hours, after which the radicles were all deliberately rubbed off; observation in petri dishes showed that there was a 100 per cent re-growth of radicles, and it may be assumed therefore that early damage to radicles does not impair subsequent growth, although it does undoubtedly delay growth, and it would appear that the optimum period for which germination should be carried out after soaking is in the region of 36 hr.

During and after the broadcasting operation, water was drained off the plots and two small pumps were also employed to speed up the process: draining-off was somewhat overdone, however, and by the 2nd July, 1954, some of the plots were showing signs of drying-up, so the process was reversed and water was pumped in between the 2nd and 5th July inclusive. On the 6th and 7th July, a total of 0.82 in. of rain fell and no more pumping was necessary until the 13th July, when a further 11 hours pumping was carried out. From the 14th July onwards, rain fell regularly and no further pumping was required.

No damage occurred to the young seedlings from outside agencies, i.e. birds, crabs, ducks etc., but as a result of water shortage, weed growth was noted as being strong, particularly in the higher plots, and there appeared to be some danger of the young seedlings in these plots being swamped by weed growth.

Weed Control

The application of herbicides was carried out in the observation area between the 14th and 19th August, 1954, i.e. about seven weeks after broadcasting, when the padi was about 2 ft. high.

The following herbicides were made available for trial:

A — " Agroxone 4"—liquid formulation of the potassium salt of M.C.P.A., containing 4 lb. of M.C.P. acid-equivalent per Imperial gallon.

B — M.C.P.A. iso-butyl ester containing 5 lb. of M.C.P. acid-equivalent per Imperial gallon.

C — 2,4,5-T mixed butyl and iso-butyl esters containing 5 lb. of 2,4,5-T acid-equivalent per Imperial gallon of the formulation.

D — "Floroxone"—mixed formulation of 2,4,5-T and 2,4-D esters containing 4 lb. of the acid-equivalent of each chemical, i.e. a total of 8 lb. acid-equivalent per Imperial gallon.

E — " Fernoxone"—2,4-D sodium salt containing approximately 0.6 lb. of 2,4-D acid-equivalent per pound of the product.

The first four of these herbicides were applied in the form of liquid sprays and the fifth in the form of a dry dust. The layout comprised three blocks measuring 198 x 396 ft. each, each block consisting of six plots of 198 x 66 ft. Treatments were split for the application of herbi-

cide at three different rates, namely 1, 2 and 3 lb. acid-equivalent per acre, sub-plot size being 66 x 66 ft. Treatments were not randomized within blocks and the results of the trial could not, therefore, be statistically analysed; the trial could be best described as a replicated observation.

Method of Application

The liquid spray treatments were applied using two Favori-Colibri knapsack sprayers connected by a 12 ft. galvanised pipe boom fitted with six equally-spaced, low-volume nozzles. The dust treatments were applied by means of a Siroco hand duster, which proved quite effective for the small plots used. For the treatment of discards, a Dexion boom, 16 ft. long and fitted with five pairs of low-volume nozzles, and an Allman Midget power duster on a two-man carrying frame were used; the latter, although emitting a good cloud of dust, proved to be rather heavy and somewhat cumbersome to manage.

The volume of water used for the spray treatments was between 20 and 30 gallons per acre, and this quantity ensured a good coverage in all plots.

Table III shows the more common weeds present in the area, the degree of susceptibility and the time before action of herbicides took place.

Effect of Herbicides

Padi at seven weeks old has grown so tall and tillered to such an extent that it is not possible to ensure that all weeds are adequately covered by herbicides since the padi itself acts as a shelter. A more suitable age for application would have been four to five weeks, when the padi was about 1 ft. high and tillering was less extensive.

Due to the unevenness of sowing rates, it was difficult to decide whether or not any damage had been caused to the padi by the application of herbicides: in those areas where the seedling population was dense, plants showed a definite yellow tinge; in those areas of normal seedling population, however, the colour was the usual dark green. It is probably correct to assume that no damage to the padi was caused by the herbicide applications even at the highest rate.

By the end of September, the whole area showed typical signs of nitrogen deficiency, and consequently a dressing of sulphate of ammonia at the rate of 30 lb. nitrogen per acre was applied overall. The effect of this dressing was most noticeable in that all the treated plots responded immediately, whereas the control plots remained yellow due to heavy weed competition.

The effect of all the liquid spray treatments was very impressive, but there was no noticeable difference between the three levels of application. The dust treatment was equally effective, but practical considerations made application more difficult owing to the fact that even a slight breeze resulted in considerable drift; dusting therefore had to be confined to the early mornings, until about 8.30 a.m., before a breeze started and while the dew was still on the leaves.

Table III.

Susceptibility of Various Weeds to the Herbicides.

Weed	Susceptibility	Remarks
Monochoria vaginalis var.: *plantaginae* (Malay: *keladi agas*)	Very susceptible	Killed by all 5 herbicides within 48 hr.
Fimbristylis globulosa (Malay: *purun*)	Very susceptible	Killed by all 5 herbicides within 48 hr.
Jussiaea repens (Malay: *tenggek bangau*)	Very susceptible	Killed by all 5 herbicides within 48 hr.
Fimbristylis miliacea (Malay: *janggut keli*)	Susceptible	Killed by all 5 herbicides within 3 days.
Scirpus grossus (Malay: *menderong*)	Fairly susceptible	No visible action takes place until a week after application, when stems rot at water level.
Nymphaea stellata (Malay: *telipok*)	Fairly susceptible	Effect is slow but final.
Hydrocera triflora (Malay: *inai ayer*)	Resistant	All herbicides cause temporary leaf curl, but recovery takes place.
Blyxa malayana (Malay: *serua ayer*)	Resistant	Leaf curl takes place but plants recover.
Panicum amplexicaule (Malay: *menyolok*)	Very resistant	No effect.
Oryza fatua (Malay: *padi yang*)	Very resistant	No effect.

Although no estimations of weed intensity were made in the treated or control plots, the latter were easily recognisable from a distance by reason of the stunted growth of padi and the luxuriant growth of weeds.

As growth advanced and ripening commenced, the padi in the area became completely lodged, not only in the treated plots but throughout the whole of the broadcast area; this was undoubtedly due to too high a population density and, in part, to the application of a top-dressing of nitrogen in the absence of phosphate and potash.

Since the area in which the weed control observations were laid down had been earmarked for carrying out performance trials using the Massey Harris 80 Combine Harvester, it was not possible to record the

yields from the whole of each treated plot; instead, an area of 11 x 11 ft. was chosen at random from each sub-plot and these areas were harvested by hand and the yield of grain recorded.

Treatment totals from the sample plots are given in Table IV.

Table IV.

Yield of Grain.

(lb. per acre.)

Treatment	Lb. Acid Equivalent per Acre			
	1	2	3	Mean
A "Agroxone 4"	3,743	3,426	3,849	3,673
B MCPA Iso-Butyl Ester	3,757	3,228	3,452	3,479
C 2,4,5-T Mixed Esters	3,545	3,915	3,624	3,695
D "Floroxone"	3,902	3,982	3,386	3,757
E "Fernoxone"	4,881	4,259	4,325	4,489
F Control	2,447	2,857	3,796	3,034

It will be seen that the highest yield was obtained from Treatment E, the lowest from Control, and Treatments A to D did not differ greatly.

Conclusions

Since the layout of these observation plots was completely systematic, no firm conclusions can be drawn from the harvest results; the land in question is, however, a particularly uniform area and yield figures can fairly be regarded as indicative of probable trends, and there is no doubt but that the use of herbicides exercised a high degree of control over the existing weed growth.

No wide differences were found in the relative effectiveness of the five herbicides tested.

Similarly, no noticeable differences were observed between the three rates of application of the various herbicides, and it is obvious that the optimum rate lies somewhere below one pound acid-equivalent per acre. (Note. These observations are being followed-up by a randomised experiment in which dosage rates of ½, ¾ and 1 lb. acid-equivalent per acre are being used.)

Summary

1. The operations involved in the complete mechanisation of a crop of wet padi at Telok Chengai Padi Experiment Station, Kedah, are described.
2. The working rates of the various operations are listed.
3. An indication is given of the effectiveness of five different herbicides, at three rates of application, on the control of ten weeds commonly occurring in padi fields in North Kedah.

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A CENSUS OF AGRICULTURAL MACHINERY IN THE FEDERATION OF MALAYA, DECEMBER, 1954.

BY

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Although a small number of tractors were used for agricultural work in Malaya before the war, it was not until 1948 that serious attention was given to the possibility of using tractors and implements on estates and smallholdings. Numerous difficulties, not the least of which was the lack of trained operators, had to be overcome and progress was at first slow. In 1949, however, a census carried out by the Department of Agriculture (1) revealed that 8.9 per cent of all large estates in the Federation of Malaya were using tractors for field work, and in 1951 the Department of Agriculture undertook mechanical work for smallholders on a contract basis for the first time. During the period 1951 to 1953 there was a considerable increase in the use of agricultural machinery on large estates and smallholders became increasingly aware of the benefits of mechanisation. A few smallholders purchased their own equipment but, in the main, the needs of smallholders were met by contract services operated by the Rural and Industrial Development Authority and, to a lesser extent, the Department of Agriculture. These centralized contracting services could not operate very efficiently because of high overhead costs and, in 1954, a number of small, local contracting firms were established. There were, at the same time, signs that the initial enthusiasm for mechanisation was waning and that estate managers were reviewing their machines and methods with critical eyes before ordering replacements for their worn out equipment. By the end of 1954, therefore, the agricultural machinery trade was in a state of flux with the Government and quasi-Government departments dropping out of the market and with prospective customers becoming increasingly critical.

The Census of Mechanical Field Equipment carried out by the Department of Agriculture in 1949 (1) yielded much useful information and it was proposed that an annual Census should be made. Questionnaires were sent out to estates in the following year but only about 46 per cent of the number sent out were returned and the analysis of returns suggested that there had been a decrease in the use of mechanical equipment, whereas observation had shown the reverse to be true. It was decided, therefore, that the report of the 1950 Census would not be published and that, in future, the Census would be carried out every five years: a third Census was therefore carried out in December, 1954.

The 1954 Census was carried out in three parts, a census of agricultural machinery in use on large estates of over 100 acres, a census of equipment owned by Government and quasi-Government contracting services and a census of machinery owned by smallholders and small contractors. The first and second parts of the Census presented few difficulties and an analysis of the results is presented in this paper. The census of smallholders and small contractors was not, however, successful; it was estimated that some 220 tractors were used by individuals in December, 1954, but it was difficult to contact the owners and details of only 36 tractors were received. It is, therefore, considered that this part of the Census was a failure and that an analysis of the results obtained would be misleading.

PART I.

Census of Agricultural Machinery on Estates of More Than 100 Acres.

GENERAL.

The distribution of questionnaires (which were similar to those designed for the unsuccessful 1950 Census (1)) and the collection of replies were undertaken by the Registrar of Statistics, Federation of Malaya. Of the 2,754 questionnaires despatched, 2,204 (or 83.3 per cent) were returned: the sample of estates was therefore similar to that obtained during the 1949 Census (1) when 84.6 per cent of the questionnaires sent out were returned. In the tables which follow, percentages are based on the number of returns, i.e. 2,204, and not on the number of questionnaires despatched.

The number of estates to which questionnaires were sent, the number of returns received and the number and percentage of estates showing agricultural machinery on their returns are given in Table I together with corresponding information from the 1949 Census. It will be noted that 488 returns, or 22.1 per cent of the total received, are shown as 'Unaddressed'; these questionnaires bore no address and were, unfortunately, separated from their post-marked envelopes before they were received for analysis. It will be seen from Table I that 396 estates were using agricultural machinery at the end of 1954; this is equivalent to 18 per cent of the estates making returns or 14.4 per cent of all estates in the Federation and is roughly double the number using machinery at the end of 1949 (1).

The questionnaires returned by estates during the 1954 Census were compared with those received for the 1949 Census. It was found that 294, or 77.7 per cent, of the 396 estates now using machinery were not doing so five years ago and that, of the 186 estates which were using machinery in 1949:—

13 were using the same machinery,
84 were using more machinery,
5 were using less machinery, and
38 had given up using machinery by the end of 1954.

The remaining 46 estates submitted returns in 1949 but not in 1954 and it is not, therefore, possible to say what, if any, changes have occurred. Of the 38 estates that have given up the use of machinery, none was using wheeled tractors and only two were using tracked tractors at the time of the 1949 Census: the remaining 36 were using horticultural tractors, chain saws and grass cutters.

Table I.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Number of Estates Making Returns and Number and Percentage of Estates Using Agricultural Machinery.

State or Settlement	No. of Estates to which Questionnaires were Despatched		No. of Estates Making Returns		No. of Estates Using Agricultural Machinery		Percentage of Estates Using Agricultural Machinery	
	1949	1954	1949	1954	1949	1954	1949	1954
Perlis	N.A.	6	5	4	0	1	0	25.0
Kedah	N.A.	274	196	153	19	41	9.7	26.8
Pg. & P. Wellesley	N.A.	88	82	83	18	26	22.2	31.3
Kelantan	N.A.	56	39	36	2	5	5.1	14.5
Trengganu	N.A.	41	25	21	0	2	0	10.0
Perak	N.A.	456	445	334	77	92	17.3	27.5
Pahang	N.A.	238	157	137	3	11	1.9	8.0
Selangor	N.A.	428	343	322	26	79	7.6	24.5
N. Sembilan	N.A.	362	257	203	10	27	3.9	13.3
Malacca	N.A.	195	156	108	8	18	5.1	16.7
Johore	N.A.	610	394	315	23	79	5.8	25.1
Unaddressed	—	—	—	488	—	15	—	3.1
Total	2,480	2,754	2,099	2,204	186	396	8.9	18.0

N.A.=Not available.

USE OF AGRICULTURAL MACHINERY ON ESTATES OF DIFFERENT TYPES AND SIZES.

A large number of estates did not complete the sections on crops and acreages when submitting returns. This information was, however, given by most of the estates using machinery, and the numbers of estates of different types and sizes using machinery are shown in Table II. Owing to the lack of information it was not possible to calculate the percentage of estates of each type and size on the basis of the number of returns received.

Table II.

Census of Agricultural Machinery, 1954.

Numbers of Estates of Different Types and Sizes Using Agricultural Machinery.

Size (acres) / Crop	Rubber	Oil Palm	Coco-nut	Tea and Others	Not Stated	Total
Less than 499	24	1	1	6	1	33
500 — 999	25	1	—	8	1	35
1,000 — 4,999	198	7	15	30	—	250
5,000 and over	35	3	1	10	—	49
Not stated	7	—	—	4	18	29
Total	289	12	17	58	20	396

Not all of the 396 estates using agricultural machinery use tractors or other self-propelled machines. In Table III, the number and percentage of estates using different types, and combinations of types, of agricultural machinery in 1954 are compared with those in 1949. It will be seen that a larger proportion of the mechanised estates are now using tractors and that the past five years have seen a ten-fold increase in the number of estates using only wheeled tractors and their associated implements. The decrease in the number of horticultural tractors, although masked to some extent by the inclusion of self-propelled rotary hoes in this classification in the 1949 Census, has, however, been very great. Indeed, the only group of estates which has not shown any marked change, either in numbers or percentages, is that in which tracked tractors only are used.

The increase in the number of estates using wheeled tractors alone or in conjunction with tracked tractors was appreciated when the 1954 Census was planned and a section was included in the questionnaire to determine whether these tractors were used mainly for transport or for cultivations. The majority of estates using wheeled tractors completed this section and a summary of their replies is given in Table IV. The majority of estates replied "transport" or "cultivation" or "both" to this section but in a few cases other uses, such as operating hydraulic ditch cleaners or maintaining roads, were given. It will be seen from Table IV that the majority of estates—247 out of 342, or 72.2 per cent—use their wheeled tractors solely or partly for cultivations but that an appreciable number—160 out of 342, or 46.8 per cent—use wheeled tractors solely or partly for estate transport.

Table III.

CENSUS OF AGRICULTURAL MACHINERY, 1954.
Number and Percentage of Estates Using Different Types of Machinery.

Types of Machinery Used.	Number of Estates		Percentage of Estates	
	1949	1954	1949	1954
Agricultural machinery of all types	186	396	8.9	18.0
Farm and horticultural tractors of all types and self-propelled rotary hoes	136	371	6.5	16.8
Grass cutters	50	22	2.4	1.0
Power sprayers, saws, etc.		3		0.1
Tracked tractors only	10	14	0.5	0.6
Wheeled tractors only	26	242	1.3	11.0
Wheeled and tracked tractors	36	100	1.7	4.8
Horticultural tractors only	64	1	3.0	0.1
Self-propelled rotary hoe only		9		0.4
Self-propelled rotary hoes and grass cutters or power sprayers etc.		5		0.2

Table IV.

CENSUS OF AGRICULTURAL MACHINERY, 1954.
Use of Wheeled Tractors.

Tractors Used on Estates	Number of Estates Using Wheeled Tractors				
	Mainly for Transport	Mainly for Cultivation	For Both Transport and Cultivation	Not Stated	Total
Wheeled tractors only	55	114	63	10	242
Tracked and wheeled tractors	17	45	25	13	100
Total	72	159	88	23	342

In addition to the section of the questionnaire specifically concerned with the utilization of wheeled tractors, a column was provided for specifying the normal duty of other machines. In the case of estates using tracked tractors alone or in conjunction with wheeled types, the replies to the section of the questionnaire indicated that about one half of the estates used their tracked tractors for both clearing and

cultivation and that the remainder were equally divided between cultivation and clearing; in the latter case 'replanting' was specifically mentioned in many replies. Very few estates indicated the normal duties of grass cutters and self-propelled rotary hoes but where this information was given the majority of replies stated "mowing around bungalows and compound" or "cultivating nurseries."

The Number of Tractors, Implements and other Agricultural Machinery in Use on Estates.

The numbers of tractors, excavators and certain other types of machinery in use on estates in 1949 and 1954 are given in Table V. It will be seen from this table that the number of machines of all types, with the exception of horticultural tractors and self-propelled rotary hoes, has increased since 1949 and that, in most cases, the increase is proportionally greater than the increase in the number of estates using machinery (Table I): the number of wheeled tractors, for example, has increased by six times, but the number of estates using agricultural machinery has only doubled since the 1949 Census.

Table V.

Census of Agricultural Machinery, 1954.

Number of Tractors, Implements and Other Agricultural Machines in Use On Estates.

Type of Machinery	Number in Use 1949	Number in Use 1954
Tracked tractors	56	135
Wheeled tractors	101	605
Horticultural tractors and self-propelled rotary hoes	140	87
Grass cutters	114	158
Excavators, ditchers, etc.	11	58
Bulldozers, root rakes, etc.	41	133
Agricultural implements	149	1,212
Sprayers, all power driven types	N.R.	91

N.R. = Not recorded in report of 1949 Census.

The numbers of tractors and machines of different types are given in detail in Tables VI to XIV. In compiling these tables the various machines have been classified, wherever possible, in the groups used in the report of the 1949 Census (1). In the case of tractors, the makes and models have been classified according to maximum drawbar horse power as shown by Nebraska Test Reports, National Institute of Agricultural Engineering Test Reports or, where these were not available, by the manufacturer's specification: where several variants are manufactured, the tractor has been grouped according to the drawbar horse power of the standard or of the most common model.

Tracked Tractors.

The numbers of tracked tractors of different makes are given in Table VI. It will be seen that the total number of these machines has more than doubled since 1949 and that there have been comparable increases in all sizes except the 65 to 85 horse power group. It was stated above that 46 estates which were using machinery in 1949 did not submit returns for the 1954 Census. At the end of 1949 these estates were using 10 tracked tractors and it is probable that these machines, which are not included in the total of 135 shown in Table VI, are still employed for agricultural purposes.

It was not possible to differentiate between the American- and the British-built International TD6 tractors but if all of these machines are considered as American, it will be seen from Table VI that 105, or 77.8 per cent, of all tracked tractors used on estates are of American origin and that there are no British tractors of over 35 d.b.h.p. In the smaller sizes, however, some 45 per cent of the tractors of under 35 d.b.h.p. are of British manufacture.

Table VI.

CENSUS OF AGRICULTURAL MACHINERY, 1954.
Number of Tracked Tractors.

Horse Power Group, 1949 Census	Make, Model and Country of Origin	Number in 1949	Number in 1954	
More than 85 h.p.	Allis Chalmers HD. 19 (U.S A.)	9	6	20
	Caterpillar D8 (U.S.A.)		6	
	International TD24 (U.S.A.)		2	
	International TD18 and TD18A (U.S.A.)		6	
65 — 85 h.p.	Caterpillar D7 (U.S.A.)	3	3	
50 — 65 h.p.	Allis Chalmers HD7 (U.S.A.)	3	1	7
	Caterpillar D6 (U.S.A.)		1	
	International TD14 and TD14A (U.S.A.)		5	
35 — 50 h.p.	Caterpillar D4 (U.S.A.)	17	19	37
	Fiat 52 (Italy)		1	
	International TD9 (U.S.A.)		17	
25 — 35 h.p.	Caterpillar D2 (U.S.A.)	19	6	42
	Fowler MkVF and MkVFA (U.K.)		5	
	International TD6 and BTD6 (U.S.A. & U.K.)		31	
Under 25 h.p.	Bristol 22 and 20 (U.K.)	5	19	20
	Fiat 25 (Italy)		1	
Model not specified in 1954 Census	David Brown (U.K.)		1	6
	Fiat (Italy)		1	
	Karl Ritcher		2	
	Oliver (U.S.A.)		2	
Total		56	135	

So far as could be ascertained, all of the tracked tractors over 25 horse power were powered by diesel engines and only 14.7 per cent of the total had kerosene or petrol engines.

Wheeled Tractors.

The numbers of wheeled tractors of different makes are given in Table VII. The total number of tractors has increased by six times since 1949 but this increase is due to a ten-fold increase in the 25 to 35 horse power group and decreases have occurred in the larger and smaller sizes. The 46 estates using machinery in 1949 but which did not submit returns for the 1954 Census were using 11 wheeled tractors at the end of 1949: some of these 11 tractors, which are not included in the total of 605 in Table VII, may still be in use.

Table VII.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Number of Wheeled Tractors.

Horse Power Group 1949 Census	Make, Model and Country of Origin	Number in 1949	Number in 1954	
More than 45 h.p.		2	Nil	
35 — 45 h.p.	International WD6 (U.S.A.)	12	6	9
	Massey Harris 744D (U.K.)		3	
25 — 35 h.p.	Field Marshall (U.K.)	57	2	576
	Ferguson TEA, TED & TEF. (U.K.)		419	
	Fordson Major, old & new (U.K.)		144	
	International W4, etc. (U.S.A.)		5	
	Lanz Bulldog (Germany)		5	
	Nuffield M4 (U.K.)		1	
Under 25 h.p.	Farmall A, Super A, etc. (U.S.A.) or (U.K.)	30	8	14
	Massey Harris Pony (U.K.)		1	
	David Brown 25, etc. (U.K.)		5	
Model not specified in 1954 Census	Case (U.S.A.)		2	6
	John Deere (U.S.A.)		3	
	Zetor (Czechoslovakia)		1	
Total		101	605	

As in the case of the tracked International TD6, it was not possible to differentiate between American- and British-built International Farmall tractors but, even if it is assumed that all of these machines were of American origin, the great majority of wheeled tractors, 575 or 95 per cent, are of British manufacture.

In Table VIII, the wheeled tractors have been divided into groups according to the type of fuel used. It will be seen that no information

was available in 350 cases, or more than half of the total, but that kerosene was specified in 122 cases, or 21.1 per cent of the total, and diesel in 57 cases, or 9.4 per cent of the total. It is probable that most of the 'Unspecified' group were, in fact, driven by petrol engines.

Table VIII.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Power Units of Wheeled Tractors.

Make	Petrol	Kerosene	Diesel	Not Specified	Total
Ferguson	49	115	31	224	419
Fordson	1	7	10	126	144
Other makes—British	7	—	5	—	12
Other makes—not British	19	—	11	—	30
Total	76	122	57	350	605

Horticultural Tractors, Self-Propelled Rotary Hoes and Grass Cutters.

The number of horticultural tractors, self-propelled rotary hoes and grass cutters is given in Table IX. It will be seen that there has been a marked reduction in the number of horticultural machines and only a moderate increase in the number of grass cutters; as stated above, however, most of the latter machines are used for mowing around bungalows and it seems probable that many owners regard these machines as household rather than estate equipment and did not show them on their returns. The 46 estates using machinery in 1949 but which did not submit returns for the 1954 Census were using 23 horticultural tractors or self-propelled rotary hoes at the end of 1949. Some of these 23 machines, which are not included in the total of 87 shown in Table IX, may still be in use.

With one exception, the machines in this group were of British origin.

Excavators, Trenchers and Drainage Machinery.

The numbers of different types of drainage machinery are shown in Table X. It will be seen that there has been an increase in the number of excavators and similar large machines and also in the number of smaller, tractor-mounted, hydraulically-operated ditchers but that there are only three ditching ploughs in use (the three ploughs are, in fact, all on one estate). In addition to the normal drainage machinery shown in Table X, the returns showed that three estates were using water pumps for desilting drains.

Table IX.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Horticultural Tractors, Self-Propelled Rotary Hoes and Grass Cutters.

Type	Make	Number in 1949	Number in 1954		
Horticultural tractors	Ransome MG5	140	10	18	87
	Others		8		
Self-propelled rotary hoes	Howard Gem		69		
Grass cutters	Allen	114	76	158	
	Lloyd		20		
	Hayter		37		
	Others or not specified		25		
Total		254	245		

Table X.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Excavators, Trenchers and Drainage Machines.

Type	Make and Model	Number in 1949	Number in 1954		
Excavators, drag lines, etc.	Priestman Wolf	11	27	35	58
	Ruston Bucyrus 10 RB		4		
	Others		4		
Chain trenchers	All makes		2		
Floating dredges	Lilliput		2		
Tractor-mounted, hydraulically-operated ditchers	Hopto		12		
	Shawnee		5		
	Stanhay		2		
Ditching ploughs	All makes		3		
Total		11	61		

Road-Making and Maintenance Machinery.

The numbers of road making machines of different types are given in Table XI. It will be seen that there are a few specialised machines such as 'Road Patrols' and rollers in use on estates and that considerable numbers of wheeled tractors are equipped with mounted terracer blades, earth scoops or bulldozer blades for earth road maintenance. In addition to these tractor-mounted implements, many of the

bulldozer blades for tracked tractors shown in Table XII are probably used, on occasions, for road maintenance.

Table XI.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Road-Making and Maintenance Machines.

Type	Make and Model	Number in 1949	Number in 1954	
'Road Patrols' and motorized graders	All makes	NR	10	20
Road rollers	— do —	NR	8	
Dumpers, etc.	— do —	NR	2	
Bulldozer blades for wheeled tractors	All makes	NR	25	
Tractor-mounted earth scoops and terracer blades	All makes	NR	95	
Total		NR	140	

NR = Not recorded in report of 1949 Census.

Clearing and Replanting Machinery.

The numbers of bulldozer blades, root-rakes, post-hole diggers and other machines used in land clearing and replanting are given in Table XII. It will be seen that the number of bulldozer and angle dozer blades is only 53.3 per cent of the number of tracked tractors (Table VI) although, as stated above, about 75 per cent of the estate managers using this type of tractor stated that they were used partly or solely for clearing: it would appear, therefore, that some estate managers consider the dozer to be an integral part of the tractor and did not enter it separately.

Table XII.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Number of Bulldozer Blades, Root-Rakes, Post-Hole Diggers, Etc.

Type	Number in 1949	Number in 1954
Bulldozers and angle dozers for tracked tractors	41	72
Root-rakes for tracked tractors	NR	21
Stumpers and tree felling booms	NR	15
Winches, tractor-mounted and other types	NR	16
Saws, tractor-mounted and other types	NR	16
Post-hole diggers	NR	39
Total	41	179

NR = Not recorded in report of 1949 Census.

It is probable that the 25 bulldozer blades for wheeled tractors are used more for earth road maintenance than for clearing and they have therefore been included in Table XI. A total of 21 root-rakes was also entered by estates which owned only wheeled tractors but it was considered that these were probably tractor-mounted tillers, and they have been included as cultivation implements in Table XIII.

Cultivation and Weed or Cover Crop Control Implements.

The numbers of cultivation and weed or cover crop control implements are shown in Table XIII. The numbers of conventional implements—the ploughs and harrows—have shown marked increases: these increases are, however, almost exactly proportional to the increase in the number of tractors.

Table XIII.

CENSUS OF AGRICULTURAL MACHINERY, 1954.
Cultivation and Weed or Cover Crop Control Implements

Type of Implement	Number in 1949	Number in 1954
Mouldboard ploughs, tractor-mounted or trailer	22	117
Disc ploughs, — do —	34	295
Harrows (1) disc, — do —	65	359
(2) others, — do —	NR	2
Tillers	NR	77
Subsoilers	NR	22
Rotary cultivators, tractor-mounted	28	45
Brush cutters (1) rotary type, mounted or trailer	NR	10
(2) Kedah roll type	NR	2
(3) Kedah roll type, locally made	NR	36
(4) anchor chains		8
Mowers, tractor-mounted or trailed	NR	55

NR = Not recorded in the report of the 1949 Census.

A considerable number of rigid tine and spring-loaded tine tillers and subsoilers are now in use on estates and there has been an increase in the number of tractor-mounted rotary cultivators; in 1949 nearly 75 per cent of the last named implements were used on estates in Province Wellesley and one district of Perak but they are now distributed throughout the country. In recent years, considerable interest has been shown in methods of destroying the vegetative cover and it will be seen from Table XIII that significant numbers of brush cutters of different types are now in use; these implements were not recorded in the report of the 1949 Census (1) but examination of the 1949 returns showed that there was only one implement in this group—an anchor chain—in use at that time.

Sprayers and Trailers.

The numbers of sprayers and trailers are given in Table XIV. The majority of the 91 sprayers are clearly used for herbicide spraying since only four estates mentioned pest control in the 'Normal Duty' section of the questionnaire.

Table XIV.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Sprayers, Trailers, Etc.

Type of Implement or Machine	Number in 1949	Number in 1954
Sprayers — tractor-mounted	NR	62
— others, power operated	NR	26
— TIFA	NR	3
Trailers	NR	67
Transport boxes, tractor-mounted	NR	5
Opperman Mo-cart	NR	1
Manure spreaders	NR	2

NR = Not recorded in report of 1949 Census (1).

It appears that many estates did not include their trailers when completing the questionnaire since the number of trailers shown was less than the number of estates which stated that their wheeled tractors were used mainly for transport (Table IV).

DISCUSSION.

The Census shows that, at the end of 1954, 396 estates out of the total of 2,754, or approximately one in every seven, were using agricultural machinery. Of these estates, only 102 had been using machinery for five years or more and the remaining 294 were, comparatively speaking, newcomers to mechanisation: only time will tell whether or not these estates will purchase new machinery when their present equipment wears out, but it is of interest to note that only two estates which were using tractors for cultivation at the end of 1949 had reverted to hand labour by 1954.

The Census revealed that the increase in the number of tractors, particularly wheeled tractors, in the past five years, is roughly double the increase in the number of estates using tractors or, in other words, the average mechanised estate in 1954 was using twice as many tractors as its counterpart in 1949. The total replacement value of the agricultural machinery in use on estates in 1954 was, in round figures, $11 million, or an average of $28,000 per mechanised estate, whereas at the end of 1949 the value of the agricultural machinery (at 1954 replace-

ment values) was, very approximately, $3.5 million, or an average of only $19,000 per mechanised estate.

The most note-worthy trend in the five years between 1949 and 1954, however, was not in the steady increase in the number of highly mechanised estates with many thousands of dollars invested in tracked tractors and excavators but in the ten-fold increase in the number of estates using only one or two wheeled tractors and their associated implements. Such estates, which comprise two-thirds of all mechanised estates, have made no great capital investment, and they are not entirely dependent on their tractors for the working of the land. A delay caused by a breakdown does not, therefore, have very serious consequences, and it is not necessary for further capital investment to be made in provision of workshop facilities or in stocks of spare parts for "first aid" repairs.

The increase in the number of wheeled tractors in the 25 to 35 h.p. group has been accompanied by a decline in the numbers of larger and smaller sizes of wheeled tractors and of horticultural tractors and self-propelled rotary hoes. The Census does not reveal the causes of this decline but it was not unexpected. The large wheeled tractors, which are generally unsuitable for transport work, were at one time favoured by estates on heavy soils but experience has shown that small tracked tractors are preferable since they do not become bogged so easily and can cross scupper drains without difficulty. The Department of Agriculture's mechanisation investigations have shown that, in general, horticultural tractors designed for temperate countries are not powerful or strong enough for cultivations in Malaya and it is probable that it is this lack of power and strength which has led to the decrease in the number of this type of machine on estates.

Of the 135 tracked tractors now in use on estates, 56, or rather less than half, are now over five years old. Under normal conditions, five years is not a great age for a tractor of this type and the question of replacement has probably not arisen in many cases. Five years is, however, a reasonable useful life for a wheeled tractor under estate conditions and replacements for the 101 wheeled tractors which have been in use since before 1949 will soon be required. With the present number of tractors in use it is reasonable to assume that some 80 to 100 wheeled tractors and some 10 to 20 tracked tractors will ultimately be required each year for the replacement of worn out machines.

Although tractors were originally introduced for clearing and cultivation work, internal estate transport has now become an important function of wheeled tractors; 160 estates, or almost one half of the estates using tractors, use their wheeled tractors mainly or partly for transport.

Associated with the widespread use of tractors for transport is the increased use of road-making and maintenance machinery and, in particular, the small tractor-mounted terracer blades. These small implements have proved very useful for regrading existing roads to pre-

serve the shape of the crown of the road and so facilitate the run-off of rain water.

The great importance attached to drain maintenance on certain types of soil is stressed by the number of large and very expensive excavators which are now in use. These large machines, which are found mainly on coconut estates on coastal clay soils, cannot be used for clearing small field drains and they are being supplemented on some estates by small, tractor-mounted ditchers. These ditchers must straddle the ditch and on some estates they have been mounted on modified tractors with very wide-set wheels. Even when this has been done, however, the tractor-mounted ditchers leave something to be desired and, since the difficulty of using a ditching plough for cleaning drains has not yet been solved, there is obviously scope for improved cleaning machinery for small field drains.

In the early days of mechanical cultivation on estates in Malaya, the emphasis was on the eradication of *lalang (Imperata cylindrica)*, a legacy from the war-time years of neglect. Conventional implements such as ploughs and harrows, are still used for the control and eradication of *lalang* and other weeds but in recent years methods of controlling weed and cover crop growth without destroying the cover or disturbing the soil have received much attention and several types of brush cutter are now in use on estates. It seems probable that this type of implement will prove very satisfactory under Malayan conditions and it is of interest to note that there are ten rotary brush cutters already in use, although they were only very recently introduced. The managers of three estates on which this type of machine is used commented eulogistically on its performance.

PART II.

Census of Agricultural Machinery Used for Contract or Research Work by the Rural and Industrial Development Authority and the Department of Agriculture.

The distribution of questionnaires to State and Settlement Development Officers through the Executive Secretary of the Rural and Industrial Development Authority and to State and Settlement Agricultural Officers through the Chief Field Officer presented no difficulties and returns were made by all States and Settlements.

The numbers of tractors and other major machines, such as, for example, combine harvesters, in each State and Settlement are shown in Table XV. Some Departmental tractors are used mainly for research, which includes the routine maintenance of Agricultural Experiment Stations, but are available, when required, for contract work; these machines are recorded in a separate column in Table XV. The numbers of each main type of tractor and machine are shown in Table XVI.

It will be seen from these tables that agricultural machinery can be hired in every State and Settlement since Perlis is probably adequately served by the facilities available in Kedah. There are 117 tractors, of which 10 are tracked types, used solely or partly for contract work and a further 59, of which 29 are tracked types, used solely for research. Of the total of 176 tractors used for research and contract work, 115, or about 65 per cent, are Fergusons.

In addition to these 176 tractors used by large contracting services, it is estimated that there are some 220 tractors owned by individuals and available for hire in various parts of the country. As noted in this article, it proved impossible to contact the majority of owners of these tractors or to find out what machinery they were employing.

Table XV.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Tractors and Other Machines Used for Contract and Research Work.

State or Settlement	Contract Work	Contract and Research Work	Research Work	Total
Perlis	—	—	2	2
Kedah	1	—	10	11
Penang & P. Wellesley	1	1	5	7
Kelantan	11	—	11	22
Trengganu	8	—	—	8
Perak	32	11	9	52
Pahang	7	—	14	21
Selangor *	7	14	14	35
Negri Sembilan	10	5	1	16
Malacca	1	—	6	7
Johore	4	7	7	18
Federal Pool	—	—	32	32
Total	82	38	111	231

* Excluding equipment in Department of Agriculture's Federal Pool at Serdang, Selangor.

Table XVI.

CENSUS OF AGRICULTURAL MACHINERY, 1954.

Numbers of Tractors, Etc. in Use for Contract and Research Work.

Type	Contract	Contract and Research	Research	Total
Tracked tractors				
Caterpillar D8	—	—	2	2
D4	2	—	7	9
D2	—	—	1	1
International TD18	1	—	—	1
TD14	1	—	1	2
TD9	3	—	—	3
TD6	2	—	1	3
Ransomes MG5	—	—	10	10
Others	1	—	7	8
Wheeled tractors				
Ferguson	67	36	12	115
Fordson	2	2	14	18
Others	—	—	4	4
Self-propelled rotary hoes	1	—	26	27
Grass cutters				
Allen	—	—	13	13
Hayter	—	—	9	9
Others	—	—	1	1
Combine harvesters	—	—	2	2
Mobile rice mills	1	—	—	1
Others	1	—	1	2
Total	82	38	111	231

Summary.

1. The results of a Census of agricultural machinery on estates of more than 100 acres are analysed and discussed.

2. The results of a Census of tractors owned by the Rural and Industrial Development Authority and the Department of Agriculture are analysed.

3. An attempt to carry out a Census of agricultural machinery on smallholdings was a failure: less than a quarter of the estimated number of tractor owners in this classification made returns.

Reference.

(1) Berwick, E. J. H. and Haynes, D. W. M. (1950): "A Report on a Census of Mechanical Field Equipment in use on Estates in the Federation of Malaya, December, 1949" —*Malay. agric. J.*, **33,** 144.

CAULIFLOWERS IN THE HIGHLANDS

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Introduction.

Cauliflowers are among the great variety of crops grown as part of the 1,200 acre vegetable industry situated at between 3,000 and 5,000 ft. above sea level in the Cameron Highlands. After the Japanese occupation and following comprehensive variety trials carried out by the Department of Agriculture, less reliance was placed on the cabbage crop and increased crop diversification was practised.

The cauliflower is not an easy crop to grow, even in the highlands, and is best sown twice a year, in January and April, so that maturity is reached during the drier seasons.

Variety Trials.

Earlier work by Allen (1) and Berwick and Tan Ah King (2) had compared the performance of a dozen varieties of cauliflower imported from Australia, India and the United States of America. From these trials the American variety "Burpeeana" was established as the most suitable cauliflower for highland cultivation. Calculated yields of over 12,500 lb. per acre were recorded in one trial and nearly 10,500 lb. per acre in another.

More recent trials, carried out in 1955, have shown an improvement in strain of the variety 'Sutton's Snowball'—seed of which can be obtained from the Sterling Area. At the same time, there would appear to be a decline in the yielding power of "Burpeeana." This is shown in Tables I and II.

Table I

Yields and 'Head' Weights of Cauliflower Varieties.
Expt. C.H. 1/55 (1st crop).
(Sown 6th January, 1955. Harvested 16th April to 6th May, 1955.)

Variety	Origin	Total Yield in ¼ lb	Average 'Head' Weight in oz.	Calculated Yield in lb. per acre	
A. Sutton's Snowball	India	221	11.2	6,020	± 695.7613
B. Snowdrift 14	U.S.A.	131	10.7	3,570	
C. Snowdrift 16	U.S.A.	213	12.7	5,800	
D. Early Snowball 34A	U.S.A.	164	8.4	4,460	
E. Pua Kea	Hawaii	—	—	—	

"A" significantly higher yield than "B" at 5 per cent.
"C" „ „ „ „ "B" at 5 „ „
(S.E. of a single observation ± 36.1247).

Table II

Yields and 'Head' Weights of Cauliflower Varieties.
Expt. C.H. 1/55 (2nd crop).

(Sown 17th May, 1955. Harvested 25th August to 26th Sept., 1955.)

Variety	Origin	Total Yield in ¼ lb.	Average 'Head' Weight in oz.	Calculated Yield in lb. per acre	
A. Sutton's Snowball	India	517	15.0	14,100	± 1027.5327
B. Snowdrift 14	U.S.A.	348	12.5	9,500	
C. Snowdrift 16	U.S.A.	429	14.0	11,700	
D. Early Snowball 34A	U.S.A.	367	11.0	10,000	
E. Burpeeana	U.S.A.	316	9.5	8,600	

"A" significantly higher yield than "D" and "B" at 1 per cent.
"A" " " " " "E" at .1 per cent.
"C" " " " " "E" at 5 per cent.
(S.E. of a single observation ± 52.3760).

It is interesting to note that the variety 'Pua Kea', recently bred in Hawaii, came into flower only two weeks after transplanting. In lowland trials at Kuala Lumpur this variety has also failed to head and it is clearly unsuited to the Malayan environment.

Sutton's Snowball, the highest yielder, produced white curds (heads) averaging from 11 to 15 oz. each, trimmed weight. The second highest yielder, Snowdrift 16, gave curds with a pink tinge which were not so acceptable commercially.

Field Practice.

In both trials the seedlings were planted out at 18 x 18 in. from nursery beds. The ground had been well prepared beforehand and well-rotted compost at just over 1 ton per acre had been added. Just under 900 lb. per acre of a $N : P_2O_5 : K_2O$ mixture (9.7 : 9.7 : 11.4) was applied as a top-dressing a fortnight after planting out. A fortnight later, prawn dust was applied at 10,500 lb. per acre.

Plants were sprayed every three days with a dispersible B.H.C. compound and Paris Green baits were laid against cutworms. For the first crop (the lighter one), spraying with miscible D.D.T. against caterpillars of the Diamond Back Moth was rendered ineffective by very heavy rainfall.

Discussion.

Although accurate records are not available, it appears that the cauliflower industry at Cameron Highlands has never exceeded $20,000 to $30,000 in annual value. Never more than a total of two to three acres of land is devoted to this crop. It is difficult to account for this low acreage when it is realised that the cultivation of cauliflower can yield considerably over $10,000 (retail value) worth of produce per acre

per four months. Retail stalls in Kuala Lumpur are currently (31st January, 1956) selling Australian and Italian cauliflowers of poor appearance and fair quality at just over $1 per lb. Tinned cauliflower is cheaper (80 cents per lb.) but the frozen product retails at over $2.50 per lb.

What is responsible for the success of this foreign competition? The present unsettled state of affairs due to Communist terrorism, cumulative soil erosion and lack of capital with which to purchase the necessary fertilisers are, in turn, held responsible. The first two reasons have already brought about some reduction in acreage of another brassica crop—cabbage. The third reason, lack of capital, is a plausible one but unlikely since other crops requiring heavy applications of fertiliser, e.g. tomatoes, are widely grown.

There is little doubt also that the isolation of Cameron Highlands growers from their markets and from established suppliers of horticultural goods and sundries compels them to sell and buy with a few middlemen who are also the transport owners. Such middlemen prefer not to trade in many different kinds of vegetables and do not, therefore, encourage crop diversification. Further, much of the growers' money is wasted on so-called fertilisers (supplied by the transport owners) which have little to recommend them apart from their smell and appearance.

Conclusion.

When the economic structure of the small highland vegetable industry is less weighted against the growers themselves and when crop diversification is again considered, it is hoped that confidence in the cauliflower variety 'Sutton's Snowball' will spread among growers and that imports, however small, will become unnecessary—at least during some months of the year.

Acknowledgements.

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NOTES ON CURRENT INVESTIGATIONS (RESEARCH) APRIL TO JUNE, 1956.

Compiled by the Assistant Director of Agriculture (Research).

Padi.

Variety Selection

In a trial just completed in Krian, Perak, a new selection, Mayang Sa Batil 19, has significantly outyielded all other strains, its mean yield over the last three years being 3,289 lb. per acre. This represents a 20 per cent increase over the standard variety M.S.B.8. At Sungei Manik and Bruas Padi Test Stations in South and Central Perak, Radin Che Ali and Seri Raja significantly outyielded the Serendah Sungei Dua and Mayang Tekai selections S.S.D.25 and 42 and M.T.41 and 72 from Kedah.

In trials of short term varieties in Pahang, Acheh Puteh has been consistently the best yielding variety at Temerloh (mean yield for three seasons, 2,378 lb. per acre) and Anak Ikan Rendah (mean yield 1,689 lb. per acre) at Kerdau. The shortest term varieties Radin Kling and Haji Haroun were consistently the worst yielding due chiefly to excessive bird damage at harvest.

In incompleted trials, Radin Ebos lines in Kedah are still showing promise both in the ear row and variety trial stages and are being multiplied up in anticipation of one or more being suitable for an extension trial in 1957.

The performance of the Radin Kling ear rows at Telok Chengai, Kedah, has confirmed that this variety is a pure line and selection work with it has therefore been concluded.

The new Seraup selections in North Perak continue to outyield Seraup Kechil 48, the present standard Seraup. At Titi Serong and Simpang Tiga, increases were of the order of 50 per cent.

About to be sown for next season at 46 stations are 51 variety trials, 9,466 ear rows for pure line selection (including hybrid material), 1,055 seed lines, 492 observation plots and five variety collections containing some 1,200 varieties.

Hybridisation

Yields from progeny plots in the last season were much improved at both Telok Chengai and Pulau Gadong but active segregation, especially in *indica* x *japonica* hybrids, continues.

The superior behaviour of the *indica* x *japonica* hybrids at Telok Chengai is well marked and, in general, selection of material there for ear rows in the coming season was based on a single plant yield of 100 gm. At this station maximum yields in the F5 reached 2,790 lb. per

acre as against 1,759 lb. at Pulau Gadong Padi Experiment Station. At the latter station however, *indica* crosses gave up to 4,639 lb. per acre of dry padi.

For planting in the coming season there are 3,687 pedigree lines of *indica* hybrids representing 105 progenies in F4 to F6 and 2,591 lines of *indica* x *japonica* hybrids representing 137 progenies in F2 to F6. In addition, 14 *indica* x *japonica* progenies are being grown in off and main seasons at Bukit Merah Padi Experiment Station, Province Wellesley.

Extension Trials

Results of only one trial are yet to hand and this, a variety and manurial trial on smallholders' land in four mukims (parishes) in the Raub District of Pahang, has shown a significant increase in yield by Serendah Kuning 23 over the local varieties.

PHYSIOLOGY

Photoperiodism

Investigations into the effects of controlled day length and effects of different dates of sowing on different varieties are continuing and new field trials have been commenced.

Water Relations

An experiment has been set up in tank culture to assess the effects of the following off-season soil treatments on main crop growth:—(i) dry soil, (ii) stagnant water, (iii) cultivation of tobacco, and (iv) cultivation of Pebifun padi.

Nutrition

A recently completed experiment has confirmed previous results which showed that, in pot culture, normal yields of padi can be obtained on peat by the application of nitrogen. These results have not been confirmed in field trials and the question of pot culture methods failing to reproduce field conditions is being investigated.

Analyses of seedlings from manured (ammonium phosphate) and unmanured nurseries showed that those in the former, in addition to being larger, had a much higher phosphate content.

DISEASES

Isolations were made from seeds originating on plants heavily attacked by blast (*Piricularia oryzae*). This fungus was not obtained from any of these seeds, which gives support to the view that *Piricularia* is not commonly seed-borne.

Fungi isolated from padi seeds and not previously recorded on that host include *Fusicladina* sp., *Aspergillus tamarii, A. niger, Syncephalastrum racemosum, Rhizopus cohnii* and three species of *Curvularia, C. pallescens., C. fallax and C. affinis.*

Pests

Preliminary examination of the results of investigations over the past two years into stem-borer on padi indicate that these pests cause far greater losses than was hitherto realised. In Krian, it was found that the most intense borer attack appears to have taken place in the Sungei Bakau area (N-W.) with a second centre near Sungei Bahru (S-W.). These areas had about 60 per cent of the tillers bored. A large area in S-E. Krian had less than 30 per cent attack.

Soil Surveys

Completion of the survey of 49,000 acres in the Kuala Langat district of Selangor showed 39,000 acres to be covered with deep peat and 7,000 acres to be undulating land, leaving only 3,000 acres suitable for padi. On the other hand, the survey, now completed, of 34,000 acres in the south-east of the Trans-Perak area has shown this to be one of the most promising areas for padi so far examined, peat being completely absent.

The survey of padi areas in the Kedah-Perlis plain has been completed but for final delineation of soil type boundaries. Twenty-two soil series, falling into four fertility groups, have been identified.

Cacao.

Selection

About 1,900 seeds of 28 progenies for planting in a selection block have been despatched to the Federal Experiment Station, Jerangau, and some 4,573 seeds from 123 Upper Amazon pods supplied to an estate.

A second trial to compare 14 progenies of various Trinitario, Criollo, Amelonado and Upper Amazon parents was planted at Jerangau in May.

In a comparison of local Trinitario with Amelonado, in 1955 the latter gave about twice the yield of the former. On the other hand, as compared with 1954, in 1955 the Trinitario yield has doubled while that of Amelonado has increased by only 28 per cent. In two of the Trinitario progenies the yield of fresh beans was as high as that from Amelonado.

In a trial comparing five Indonesian Trinitario progenies with Amelonado, the yields for the first half of 1956 indicate that while Amelonado is still the highest yielding it is no longer significantly superior to any other progeny; error variance in the experiment is however high (ca. 50 per cent). Again, the annual yield increase was greater for Trinitario than for Amelonado which, however, gave 853 lb. dry cocoa per acre at five years of age.

A nursery of seven I.C.S. clones, being no longer required for budwood, was allowed to fruit. In different clones, pod yield ranged from

130 to 200 gm. fresh bean, and fresh bean weight from 3.4 to 5.2 gm. I.C.S. 6 and 60 produced a good crop of large pods and beans; I.C.S. 45 and 95 had smaller pods and the latter the smallest beans.

DISEASES

Calonectria rigidiuscula in association with die-back has now been found at Subang, Selangor, and Tangkak, Johore, in addition to the Federal Experiment Station, Serdang. Inoculation tests have shown that a *Gloeosporium* sp. is responsible for a spotting and distortion of young leaves which is wide-spread in Malaya.

PESTS

Stem and leaf distortion occurring on young plants on an estate in Perak is attributed to the mealy-bug *Planococcus citri*. Leaf damage by *Prodenia litura* is reported from Trengganu.

PROCESSING

Ninety microfermentation tests have been carried out during the quarter and a further 48 are in hand. Extraction rates (prepared cocoa as percentage of fresh beans) ranged from just over 37 per cent for Amelonado and Indonesian Trinitario to 26 per cent for local Trinitario, Upper Amazon giving 31 per cent and Ceylon Trinitario 33 per cent recovery. The numbers of pods on which these determinations are based were small.

SOIL SURVEYS

With surveys carried out during the quarter in the Sungei Tebak-Bukit Bundi and Rasau-Ulu Kerteh areas of Trengganu, mapping of the main potential cacao areas in this State is complete and has revealed some 87,000 acres of soils suitable for cacao. A further 12,000 acres has already been mapped in Pahang.

A preliminary inspection of soils in the Batang Merbau area of Kelantan revealed a small area of well structured soil which may prove suitable for cacao. This area is to be surveyed in more detail next year.

Inspection of the cacao plot at Petasseh in Negri Sembilan showed that the soil, which resembles that from dolerite in Kuantan, Pahang, is in fact derived from serpentine. Poor growth of cacao on this soil may be due to excess of magnesium.

Oil Palm.

BREEDING AND SELECTION

Twenty-five bunches, involving 10 types of cross, have been pollinated and 17 pollinated bunches, giving 14,558 seed, have been harvested. Germinated seeds of 21 hybrid progenies have been supplied to four estates co-operating with the Department in its breeding programme. 15,221 seed from 14 crosses between four palm types have been sown in sand beds.

Planting of a trial (Tr. 52) to compare dumpy Dura with Tenera material at the Federal Experiment Station, Jerangau, has been completed.

The first year's records from two trials planted in 1951 on Ulu Bernam Estate show that both dumpy and dumpy-tall backcrosses are giving similar oil yields at about 0.4 tons per acre and mean bunch weights of about 9 lb. Similar genetic material of comparable age at Highlands Estate is yielding better, at the rate of 0.6 tons oil per acre and bunches of 17 lb. In the latter planting, the dumpy backcross palms are already 10 per cent larger in girth than palms of the tall x dumpy F2 progeny.

DISEASES

The pathogenicity of *Curvularia* sp. to young leaves of oil palm seedlings has been confirmed, the associated *Gloeosporium* being non-parasitic. Among other diseases recorded were a severe outbreak of *Marasmius palmivorus* bunch rot and, for the first time, an attack of young palms by *Ganoderma lucidum*.

PESTS

Dusting with BHC was found ineffective in controlling a bad outbreak of *Orgyia turbata* on seedlings in Johore and spraying with DDT is being tried. Reports of severe damage to young palms by *Oryctes rhinoceros*, breeding in felled rubber, continue to be received. The only effective control, by burning the rubber and hand collecting the insects, is expensive.

NUTRITION

Leaf analyses of samples from a 2^4NPKMg manurial experiment in Selangor, which has been in progress for three years, showed no effects on the nutrient content of fronds 3 and 17. The experiment is on fertile clay and the nutrient content of the controls is high.

Coconut.

SELECTION

Over 1,000 seedlings from selected parents are awaiting planting at the new Federal Experiment Station at Telok Bahru, Perak, and a further 400 are in germination beds.

Pineapple.

NUTRITION

Preliminary leaf analyses of the varieties Singapore Spanish and Sarawak Smooth Cayenne from the Federal Experiment Station, Jalan Kebun, were carried out to find the best method of sampling. Either the tip or base of the young, fully developed leaf was found suitable but the former was preferred as such sampling resulted in less damage to the plant.

It was noted that where potassium was deficient, the element was to a large extent replaced by magnesium both on the Sarawak and Singapore Spanish varieties. Further analyses of material from a trial on Sarawak pines with different levels of potash fertiliser showed that heavy potash applications tended to reduce uptake of N and P. These interactions will be followed up in a further manurial trial.

Processing

Current investigations on canning and analysis of fruit from trials at the Federal Experiment Station, Alor Bukit, Johore, have been resumed as the crop is maturing. These cover work on the relation of fruit maturity, as indicated by sugar/acid ratio, to skin colour. There was little difference between Selangor Green and Singapore Canning. The Mauritius was remarkable for its bright golden colour over a wide maturity range, but the fruit is small and uneconomic to can, gives a poor flavour and a pH sometimes as high as 4.4. Colour and flavour of the Sarawak pack were also poor. All four varieties are at their best for canning when 50 to 75 per cent ripe as judged by skin colour.

Tests of edible fruit recovery and canned quality of the same four local varieties have been completed and show the lowest recovery (44.4 per cent) from Sarawak, 54.2 per cent from Mauritius and the highest from Singapore Canning and Selangor Green (up to 70 per cent). Differences are largely due to yield of crush and juice material; there was however a higher percentage of bruising in the Sarawak fruit used.

Diseases

Both fruit collapse and heart rot due to *Erwinia* sp. have been recorded for the first time from South Perak; heart rot has also occurred at the Federal Experiment Station Jalan Kebun. The pathogen is therefore now known to occur in all the main pineapple areas. The possibility of its identification as a strain of *E. carotovora* is under investigation.

Attempts to control heart rot by spraying with Bordeaux mixture or streptomycin sulphate have so far been unsuccessful.

Tests with abnormally high concentrations of copper sprays in connection with the control of fruit collapse caused damage and exudation of gum on very young fruit. Damage was most serious with copper oxychloride and less so with copper oxide; Bordeaux mixture caused no damage.

Pests

Complete control of mealy bug has not been achieved by fumigation of slips and, later, spraying plants with dieldrin but the number of wilted plants has been reduced by this treatment from 10 to 3 per cent.

Fruit.

PROCESSING

Rambutan

Deep freezing trials with the husked fruit were continued for five months, with and without seed removal and with and without immersion in syrup. The fruit kept better in syrup and syrup penetration was better with the seed removed. Clones R4, R81 and R86 retained their flavour and had a satisfactory appearance; clone R11 developed a sour taste and R99 became discoloured.

Papaya

For purposes of market research, 647 lb. of Mexican papaya was canned in 229 16 oz. cans. A satisfactory jam was prepared from the trimmings with the addition of ginger to enhance flavour.

Guava

Further trials on preparation of guava jelly have produced an excellent product with good commercial possibilities. Trials on canning in syrup are projected.

PESTS AND DISEASES

Rambutans were found in Johore attacked by larvae of the coconut gelatine grub *Chalcoscelis albiguttata* which is also reported on mango, orange and pomelo. Brown root disease due to *Fomes noxius* is a new record on mangosteen.

Other Crops.

In the spacing and time of cutting trials with ramie, which have been in progress for two years, the results showed no effect of treatments on cumulative yield of fibre.

Interplanting of maize and tomato as compared with tomatoes in pure stand resulted in reduction of bacterial wilt incidence from 100 to 37 per cent. Treatment of tomato plants with streptomycin sulphate did not reduce wilt.

Puccinia polysora has been found to be widespread in Malaya on maize. Its effect in reducing yield is being studied.

A wilt disease of pepper common in Johore appears to be the same as the 'Sudden Death' disease of Sarawak, the cause of which is not yet known.

Fish.

After processing cleaned samples of Kambong *(Schember* sp.), Selayang (*Caranx* sp.) and Tenggiri (*Cybium* sp.) at 15 lb. steam pressure the bones softened and flesh remained satisfactorily firm and bright. Flavour of the canned article compared favourably with similar imported products. Recovery was 58 to 61 per cent and the offal yielded 8.3 per cent fish meal, which compared well with imported meal but was rather lower in phosphate content.

Laboratory Technique.

Nitrogen Determination

For determination of ammonia in padi field water a method using Nessler's reagent was found suitable; for nitrates the phenol disulphonic acid method was found to be best.

Mechanical Analysis

In a study of methods of soil dispersion during mechanical analyses it was found that 1.5 gm. of Tetron is as effective as the standard sodium silicate, ammonium oxalate method.

pH

Storage of soil samples for upwards of a year resulted in acidity increase by as much as one pH unit. Change in pH of soil samples during processing for storage is also under investigation.

NOTES ON CURRENT INVESTIGATIONS (AGRONOMY) APRIL TO JUNE, 1956.

Compiled by the Acting Senior Agronomist.

Padi.

Harvesting of the few trials remaining at the end of last quarter completed the field work of the 1955-56 season's programme of experiments. Off-season crops were sown at the beginning of the quarter for a number of experiments at Bukit Merah Experiment Station, Province Wellesley. Growth was generally satisfactory and the bulk of the crop was flowering at the end of June. Preparatory field work for the 1956-57 programme of experiments began in Kedah, Perlis and Pahang. Plans were completed and distributed for this programme; some new experiments have been included and the number of tests to be carried out on smallholders' land has been increased.

Most of the results of the 1955-56 series of trials were received and work began on the checking, analysing, summarising and reporting of them.

Cacao.

The quarter was a busy one at the Federal Experiment Station, Jerangau, Trengganu. Some 2,309 Amelonado pods were harvested, mainly in May, and used primarily for propagation. Much new land was planted or prepared for planting for the Botanical Division of the Research Branch. Further progress was made in the large establishment trial. Development of the new nursery and of the administrative and residential areas continued. Routine maintenance and observation were carried out in established experiments and seed gardens.

The cacao in Block D of the establishment trial made some progress but was not as well grown or as healthy at the end of the quarter as one would like. In the other blocks, shade improved considerably and planting holes were dug for the cacao. Full control of erosion and grass was not achieved, though some progress was made.

The experimental area has been marked out for the second lime-phosphate trial. Observations in the first trial continued to suggest that the treatments might have beneficial effects on growth and health, but the suggestions were not consistent or conclusive.

The major problems of crop management continued to be control of the *Helopeltis* bug and of grass; and intensification of fogging operations had gone far in solution of the former by the end of the quarter. Satisfactory ways of dealing with the latter problem had not been found.

Observations were made and recorded in the experiments which are being carried out on Jerangau Estate in co-operation with the estate.

As usual, work at the Federal Experiment Station, Serdang, mainly comprised the management of the Amelonado seed gardens and the many areas devoted to the trials and observations which the Botanical Division is conducting. A total crop of about 11,000 pods of all types was harvested. Very considerable pest control measures were carried out and preparations continued for a rootstock experiment. Musang (civets) caused substantial losses of crop in spite of a shooting campaign.

Some small scale manurial observations were laid down. These involved comparisons of potash in the sulphate and muriate forms, application of magnesium limestone and tests of various manurial mixtures.

Desmodium ovalifolium proved a most valuable cover crop in one area of young cacao at Serdang. In cacao rooting work, great differences in ease of rooting were found between various clones and types.

The cacao planted at Kampong Awah in Pahang made good progress.

Coconut.

Sporadic lalang *(Imperata cylindrica)* was brought under control in the cleared area at the Federal Experiment Station, Telok Bahru, Perak, and some drain clearing took place. Plans were completed for planting and further clearing this year.

Growth improved somewhat in the variety and manurial trials at Serdang.

Pineapple.

At the Federal Experiment Station, Jalan Kebun, Selangor, most of the established experiments were being harvested at the end of June. In those which include the Sarawak variety it is clear that the size and shape of fruit are poor when plants are widely spaced. Secondary problems also result, in that the fruits fall and become sunburnt and the sunburnt patches are more liable to pest damage. The beneficial effect on the growth and health of plants by controlling mealy bug attacks was clearly demonstrated in one of the experiments on the station. Cases of heart rot were discovered for the first time on this station.

A new experiment was laid down in Kelantan. Its purpose is to show whether certain minor elements affect the growth and crops of Mauritius pines on Bris soils.

Clearing operations began on a part of the Federal Experiment Station, Alor Bukit, in Johore. Experiments were maintained on that station and on private estates in the area.

Tea.

The first cycle of an NPK factorial trial was completed at the Federal Experiment Station, Cameron Highlands, and the bushes pruned. Yield data were received for the months of April and May. In another manurial trial the value of nitrogen in yield improvement was again demonstrated.

Establishment of clonal collections continued at the Federal Experiment Stations, Serdang and Cameron Highlands.

Fruit.

Rambutan clonal trials exist in Selangor (including the Federal Experiment Station, Serdang) and Perak. Results from these trials are gradually providing knowledge of the yielding capacities of certain clones of this fruit. A similar trial of durian clones at Serdang is beginning to give the same sort of very important information. Further clonal trials are planned for Serdang.

Considerable attention was given to the investigational needs of the programme for the expansion of local citrus fruit production. These needs are substantial. The main requirement is discovery of sound ways of multiplying good mandarin clones rapidly. Some preliminary work was started in this matter, and planning for further work was also begun.

Pastures, Fodders and Livestock.

The Minister for Agriculture's Committee on Livestock Production met twice during the quarter. Among other things, it considered investigational needs of the livestock industry of the country and initiated planning action in some of these.

The new Guinea grass manurial experiment grew very well indeed at Serdang and the first harvest was taken from it in May. The main purpose of this trial is to show how yields of grass may be produced more cheaply than is presently possible.

The Bali cattle continued to thrive on very economical feeding at Serdang.

Miscellaneous Crops and Experiments.

Oil palm experiments were maintained at the Federal Experiment Stations, Jerangau and Serdang. The majority of these are the concern of the Botanical Division.

Vegetable and foodcrop experiments were conducted at the Federal Experiment Stations, Cameron Highlands and Serdang. Methods were found of obtaining better yields of sweet potatoes than had previously been customary at Serdang.

Heavy yields were obtained from cashew nut varietal and manurial experiments in Trengganu.

NOTES ON EXTENSION WORK
APRIL TO JUNE, 1956.

Compiled by the Acting Assistant Director of Agriculture (Field).

Weather.

Rainfall was below average during the quarter along the west coast in Perak, Selangor, Malacca and Johore, and rose above average only in Perlis and Cameron Highlands. The east coast States of Kelantan and Trengganu received normal rainfall except during May when it was heavier than usual.

Padi.

1955-56 Season

Harvesting of the crop was completed except in the Sungei Panjang and Panchang Bedina areas of Selangor, and in the latter area low yields are causing some genuine hardship.

Yields have been very variable from State to State. Kelantan fared very well, with the second highest crop ever recorded, and in Perak some 13,000 tons more padi was harvested than in the preceding season. Yields in Malacca were slightly higher than last season, but in Trengganu and Negri Sembilan yields were below average due to drought and late planting respectively. Over the country as a whole, the total yield is expected to be slightly above that of the 1954-55 season.

Prices paid for the crop have risen in Kedah from $15.05 to $16.85 per pikul (133 1/3 lb.), but with little actually being sold. In Selangor there are few areas where planters have not received over $13 per pikul, and in Malacca local mills have been paying $14 to $14.25, at which price level they have not been able to compete against Selangor buyers offering $15.50 per pikul of padi. In Johore there was difficulty in disposing of the excellent crop grown on the west coast, and the Supplies Department had to be called in to purchase at the Government support price of $14 per pikul.

1956-57 Season

Rainfall in Kedah has been timely and sufficient, and 70 to 80 per cent of the land had been ploughed, and 90 to 95 per cent of the nurseries had been sown. Cultivation was started in Perlis in May, but a dry June put a halt to further ploughing and nursery sowing. Nurseries have been sown for the deep areas of Penang and Province Wellesley South, and for the padi menghulu in Kelantan and Trengganu. Good progress too has been made in Krian North where 50 per cent of the cultivation and nursery sowing has been completed, and a start has been made in other parts of Perak North and Sungei Manik. There has been

a delay of two to three months in starting padi planting in Pahang, and this is certain to lead to severe damage to the crop should the monsoon rain be normal. Cultivation has started on schedule in Malacca and Negri Sembilan, and nursery sowing is in progress in Johore.

Preparation of the land for the lowland dry padi crop has commenced in Kelantan, but drought in Trengganu has made the land too hard to plough. There has been a small demand only for tractor ploughing of dry padi land in Kelantan, but in Trengganu there is 200 acres in Mukim Tersat alone which is awaiting tractor ploughing. This area is not very accessible and it is unlikely that more than two or three tractors can be sent to work there.

In Ulu Kelantan there is estimated to be about 3,650 acres of recently felled jungle and scrub awaiting burning for the upland dry padi crop, but heavy rain in this District has delayed burning, which should have been completed in time for mid-June sowing of the padi. This large area for the planting of upland dry padi does not represent shifting cultivation, but rather only the first stage in the development of land for rubber cultivation by regrouped villagers in the vicinity of their new villages.

1956 Off-Season Padi

Satisfactory growth is reported for the padi planted on more than 600 acres in Yen, Kedah, and the prospects are good for the 7,000 acres planted in Province Wellesley Central even though planting was up to one month late. In Province Wellesley North there has been a shortage of water, and it was only possible to plant 1,353 of the 1,780 acres which had been ploughed in readiness for planting. A demonstration planting of 3½ acres of Taiwan padi has been undertaken at Pulau Gadong, Malacca, where regular spraying with Endrex has kept stem-borer damage at a low level.

General

It has recently been found that there is a regular economic response to nitrogen applied as a top dressing to the padi crop in one area lying between the Kedah River and Kedah Peak to the west of the main road and in another area to the north-east of Alor Star. Plans have been made for the laying down of 150 demonstration plots in these areas to accustom padi planters to the use of granulated urea. A second important finding also to be exploited, by the use of 78 demonstration plots, concerns the use of a complete fertiliser dressing which can be recommended for use in Kedah in the districts of Kubang Pasu, Padang Terap, Sik, and Langkawi.

The use of phosphatic manures in Kedah has for long been an established practice. There is a tradition of applying bat guano to the padi fields at the rate of about 100 gantangs (gallons) of guano per relong (.71 acre) of land at the relatively low cost of $7 per relong. During the current padi season about 185,000 gantangs of guano have already

been sold by guano extractors to padi planters, which is almost 50 per cent more than at the corresponding time last year. This widespread use of guano probably accounts for the irregular response to phosphate in padi manurial trials in Kedah. Guano is similarly used in Perlis, where, however, present prices are somewhat higher at $10 to $12.50 per 100 gantangs guano.

In several States the use of ammonium phosphate on seedlings in the nursery has had a very beneficial effect on the final yield of padi, as for example in Perak where the expenditure of $1.50 on manure brought a gross return of $18.90 per acre, equivalent to a 12 per cent increase in crop throughout the area covered by the 88 extension trials. In the same State, the cheaper rock phosphate is showing a favourable comparison with the more expensive superphosphate, although in Trengganu, whilst both types of phosphate are economic to use, the superphosphate is the more efficient.

In Malacca, the value of the subsidised fertiliser scheme has been assessed by 179 crop cutting tests at almost 3½ pikuls of padi per acre worth $46 at current prices, compared with an all-in cost of manure amounting to $31.72 per acre. This subsidised fertiliser scheme, which forms part of the programme of assistance to padi planters, will be continued during the 1956-57 padi season and, through it, it is hoped to supply manure for about 3,500 acres as compared with 2,370 acres in the 1955-56 season. Officers in the States, notably Kelantan, Trengganu, and Negri Sembilan, are also calling for tenders for the bulk supply of fertiliser and drawing up plans for distribution of it to padi planters.

The supply and distribution of pure strain padi seed selected for use in certain defined areas is an important means by which yields may be increased. Two new seed farms are being established at Sungei Raya and Pantai in Negri Sembilan where 17 acres will be planted with pure strain padi for multiplication; and in Malacca plans are being prepared for the planting of 90 acres of seed farm. Total distributions during the quarter have amounted to 6,099 gantangs pure strain seed and 708 gantangs unselected padi seed.

Padi competitions have been held at mukim (parish) and district level in practically all States and Settlements and will be followed shortly by State and Settlement competitions, the winning samples from which will be entered in the All-Malaya Padi Competition at the Malayan Agri-Horticultural Exhibition to be held in Kuala Lumpur.

In Kedah, the local type of buffalo drawn plough used in padi fields produces a furrow some 6 in. wide and 3 in. deep, and although it is light, cheap and made of local materials, it has the serious disadvantage of being slow working and incapable of breaking up hard ground. These faults are not peculiar to the Kedah type plough, and apply in large measure to other ploughs of local design and construction. Over a period of years a number of imported ploughs have been tested under Malayan conditions, but none has been found which on balance is a more suitable implement. The latest introductions have been six new types of plough

imported from Japan which have been tested on light, medium and heavy soils in Kedah. One of these was the Matsuyama which was fairly satisfactory although not good enough for adoption, and it appears likely that a better product may be developed from modification of the local type of plough.

Field work in the Kedah and Kelantan padi surveys was completed at the end of May.

Rubber.

There has been no seedfall during the quarter, and the work of the Department has been mainly in connection with the preparation of nursery sites for the seedfall expected to commence in August.

Distributions of rubber budwood and clonal seedling stumps for new planting and replanting were at a similar rate to that in the first quarter of the year, but would have been lower had not unexpectedly favourable weather in Kedah enabled large quantities of clonal seedlings to be planted out in the field. Total distributions were:

	Rubber Budwood (yd.)	Clonal Seedlings (No.)
New planting	11,655	463,635
Replanting	19,991	522,522

Reports from Kedah and Penang and Province Wellesley indicate that the progress of replanting is likely to be substantially better than in 1955.

Smallholders' latex sales in Kedah increased by 14,793 lb. (dry rubber content) to 170,485 lb. valued at $114,900, though this is still substantially less in both quantity and value than in 1955. In Taiping, Perak, latex sales fell still further to 142,932 lb., which represents a drop of 65 per cent since the end of 1955, and three other purchasing schemes in Perak closed down. It has been suggested that the failure of latex purchasing schemes in Perak may be due to the active opposition from tappers employed on the *bagi dua* (equal shares) system who have less scope for cheating the owner of his share of the crop when latex is sold on d.r.c. to a society than when processing of the rubber and its sale is done by the tapper himself.

Coconut.

The field work of the coconut survey which has been carried out on the west coast of Johore came to an end in the middle of June after 430 lots of land had been surveyed, and the data collected are being prepared for analysis. The Kelantan coconut survey field work has been commenced.

An attempt is being made in Perak to revive 1,000 acres of young coconuts at Kampong Panchor now that the elephants which have destroyed so many of the young seedlings have gone.

Completion of the Senggarang Drainage Scheme in Johore has led to continued improvement of coconut holdings in the area around Kampong Bahru, and at Simpang Merbok, Parit Quarry, Parit Sri Paya and Parit Sawadi planting with coconuts has followed the drying out of the land.

In Penang and Province Wellesley, encouragement is being given to smallholders to replant where their palms are over-age or where there is a low stand of palms per acre. Not only has the supply of Department-selected coconut seedlings been arranged but also smallholders are being shown how to undertake their own selection of nursery seedlings.

Fruit.

Light crops only are being harvested, and it appears that the prospects for the country as a whole are poor. Penang and Province Wellesley are having the lightest fruit crop for many years.

The Lower Perak mandarin orange crop came to an end in June after an improvement in price ranging between $30 and $37 per pikul. Forty acres of land has been newly planted with oranges in Perak North.

There has been steady expansion of both the Department's budwood and seedling stock nurseries, and increasing use is being made of contractors' and privately owned nurseries for the supply of budded fruit trees. There are, for example, four privately owned nurseries in Perak using the Department's budwood and a contract nursery has recently been established at Jitra, in Kedah. In Johore, the districts of Muar and Batu Pahat alone have 34 rural fruit nurseries which are growing a total of 110,000 rambutans for budding, and in Kluang District local nurseries claim to be sending budded fruit trees as far as Singapore, Malacca and Kuala Lumpur.

The Department's distributions of vegetatively propagated fruit trees during the quarter amounted to 11,387 trees, and in addition about 23,000 buds were distributed for use in other fruit nurseries.

A new, small fruit multiplication nursery has recently been established on muck soil at Kampong Jaya Stia, Selangor, since propagation work seems to be particularly easy on this type of soil. In the same locality the budding of seedling rambutans in the field is being undertaken in connection with orchard establishment in association with catch cropping, a procedure which may appeal to smallholders of limited means.

Tobacco.

Prices for locally grown cured leaf have ranged between $50 and $160 per pikul according to quality. Much of this tobacco is being grown in Perak where the four main growing areas account for about 2,850 acres, and as a result of the opening of a tobacco factory at Lenggong, smallholders are beginning to sell green leaf at prices between $20 and $30 per pikul.

In Kelantan, tobacco retains its position as a popular and profitable off-season crop and there have been signs that growers are beginning to pay more attention to details with a resultant improvement in yield and quality. Although by no means widespread as yet, the use of an inorganic tobacco fertiliser mixture has been adopted by some of the more progressive growers.

Coffee.

A fall in the price of Liberica coffee produced on the Selangor coast has been expected for some time, and it took place when the mid-year crop came on to the market. Prices fell to between $125 and $135 per pikul, compared with about $200 per pikul at the end of 1955, but there was a recovery later to about $150 to $160 per pikul. The reason for this fall is not fully understood as, although there had been a very appreciable increase in acreage during the last few years, there is not yet any large surplus on the market. The market may have been influenced to some extent by the fall in the price of rubber. Even at present prices, coffee is still an attractive crop to grow on muck soils.

Foodcrops and Vegetables.

A feature of the vegetable growing during the dry season this year in Kelantan has been the very large increase in the use of insecticides by smallholders. The popular insecticides have been preparations of B.H.C. and D.D.T. A very similar trend has been noticed too in Negri Sembilan. Until comparatively recently, no Malay grower used any form of insecticide, whilst Chinese growers made use of locally grown derris for the protection of their crops.

In Trengganu, little interest is at present shown in the cultivation of off-season vegetable crops on padi land, and in an attempt to stimulate interest, demonstration plots have been established at Gelugor and Gerai Padi Test Plots where soya bean, long bean, brinjal, loofah, lady's finger, lettuce and pak choy have been planted.

Chinese in Malacca commonly plant sweet potato, yam bean and loofah as off-season crops, but recently the Department's selections of Ceylon spinach, bayam, lady's finger and brinjal have been introduced for observation and multiplication.

Japanese varieties of water melon planted at Kuantan, Pahang, have shown some promise by reason of good flavour and texture, but yield data, etc. are not available. At the new village of Bakri in Johore, trial plantings of soya bean (C.4 selection) have been attended by good results and followed by requests for the further supply of seed.

The lower price for rubber has not stimulated off-season cropping in the Tanjong Karang area of Selangor. At Sekinchang, where there is about 850 acres under crop, there has been an increase in the planting of soya bean and groundnut at the expense of the maize crop, and a general reduction in the acreage of off-season crops in the Malay areas.

Pineapple.

The first crop of fruit harvested from the Kampong Selabak, Perak, smallholdings has been of uneven quality, and the small size of many of the fruits harvested is a reflection on the lack of proper cultivation and management of the holdings.

Good crops have been harvested from smallholdings in Selangor and Johore for sale to the pineapple canneries. The Pekan Nanas Co-operative Marketing Society has succeeded in making an improvement in fruit quality, and during the quarter marketed 275 lorry loads of fruit direct to the canneries.

Cacao.

On a Penang estate, where cacao is growing well under coconuts, planting of some 500 plants has been carried out under established fruit orchard. It is expected that by the end of the year there will be three estates in Perak each with 50 acres of cacao under coconuts.

Steady progress has been made with the Jerangau Road Cacao Pilot Scheme, where there are 17,000 seeds in the nursery. One participant in the scheme met with financial trouble and withdrew from further participation, but there was no difficulty whatsoever in finding an immediate replacement for him.

The Bukit Goh Forest Reserve soil survey was completed during June, and sites have been provisionally selected in the area for proposed Agricultural Stations.

Livestock.

Pigs

Rearers have been discouraged by the continued low prices of $80 to $90 per pikul offered for their stock and the maintenance of market meat prices at their former level.

Fifty-seven Middle White boars and 27 gilts were sold or issued on loan for stud purposes by the Department during the quarter. Services by Departmental boars totalled 262, all except 43 of which took place in new villages. Stud boars were issued on loan to eight new villages in Johore, seven of which were supplied with sties built by the Department.

Poultry

It has been reported from Perak and Negri Sembilan that there has been a reduction of interest in poultry rearing on a commercial scale, although around Batu Pahat, Johore, there has been development in the keeping of flocks of 200 to 600 pure-bred birds, especially White Leghorns. In Johore Bahru District, six farmers have recently entered the poultry trade with flocks of 1,500 to 2,000 local birds each. West

Johore prices for graded eggs for the Kuala Lumpur market range between 12 cents for eggs of under 1½ oz. in weight to 18½ cents for eggs of 2 oz. and over.

The Department's distributions of pure-bred poultry amounted to 444 cockerels and 419 pullets, as well as 1,531 eggs for hatching. Among these were 142 cockerels and 252 pullets supplied in exchange for local birds in Johore.

Mechanisation.

Ploughing of smallholders' land for padi and dry land crops such as coffee has been undertaken by the Department's tractors in Malacca and Johore, where 107 acres was cultivated during the quarter. In Province Wellesley, there is still a keen demand for rotavators, and the Department's machines were in use for 122 hours cultivating the padi land. Some 517 hours work was done in Selangor, mainly ploughing and harrowing for the eradication of lalang in smallholders' rubber replantings.

In Perak, contractors have been employed by smallholders for the cultivation of land for tobacco and tapioca, and in Lower Perak alone it is estimated that 800 acres has been so cultivated. Charges have ranged between $6 and $7 per hour and $80 and $130 per acre.

New Villages.

The need for new rubber planting has been recognised by the inhabitants of new villages in Kedah, and at Padang Lembu and Kejai it is likely that about 300 acres and 100 acres respectively will be planted this year. Funds have been obtained for the establishment of a demonstration rubber planting plot at Padang Lembu, and emergency funds have also been available for giving assistance for the establishment of new rubber by Thais living at the Kampong Chong resettlement area near Sik.

The morale of new villagers in Kelantan is high following the alienation of sufficient land for rubber, padi and vegetables and the good progress that has been made with the new village aided rubber scheme. Some of the land has been planted with clonal seedlings and the remainder with wild seedlings for budding later. Small nurseries have been established with wild seed for the training of new villagers in the technique of budding, and one budgrafting course has already been held, to which there was an encouraging response.

Progress is being made with four group resettlement areas in the Kemaman district of Trengganu where villagers are being allotted five acres for rubber, three acres for wet padi and two acres for a house and garden. It has been proposed that one such holding should be worked by the Department as a demonstration holding.

Ex-Special Constable Schemes.

The planting of rubber has been undertaken during the quarter over 411 acres of land in four settlements in Perak, where an additional

436 acres is being prepared for planting later in the year. In only a few of these schemes have the new plantings been well cared for and lalang kept out.

A Junior Agricultural Assistant has been posted to Kampong Jaya Stia, Selangor, where he is living in the kampong to help with development work.

Agricultural Education.

A new Rural Training Centre has been opened at Ayer Hitam, Johore, to accommodate 20 trainees. A total of 16 short courses was held at this and other Centres in the Federation for the benefit of 180 trainees.

Newsletters have been published in four States, and in Perak some 10,000 copies of simple, cyclostyled explanatory leaflets were prepared and distributed to all purchasers of planting material and to those interested in padi and fruit cultivation, lalang control, etc.

Longer courses of instruction have been held at Chembong, Negri Sembilan, where a general agricultural course was held for five persons for a period of two months, and at Batu Pahat, Johore, where rubber courses in Chinese and Malay were held by the Rubber Instructors of the Rubber Research Institute.

Officers of the Department have taken part in the running of 22 Civics Courses and have given 18 lectures and demonstrations to smallholders. Those on pest control in Kelantan, including the use of a "Swingfog," have been particularly well attended.

In Lower Perak, a special campaign was conducted in the padi planting areas where insufficient attention is being paid by planters to planting their padi at the correct time, and took the form of lectures and specially prepared leaflets and posters.

Departmental Notes

Obituary.

It is with profound regret that we record the loss of Enche Mohamed Kassim bin Long, who died as a result of a motor-cycle accident in the Lake Gardens on the 12th August, 1956, at the all too early age of forty-two.

Che' Kassim, one of the senior of our Junior Agricultural Assistants, had served over 22 years in the Botanical Division of the Research Branch. Selangor born, he was educated at the Permatang Pasir Malay School in Kuala Langat and became a pupil teacher from 1932 to 1933. He joined the Department as a Peon in 1934 and was promoted to Laboratory Assistant (Rice Research) in 1936. In 1938 he was promoted to Malay Agricultural Subordinate, later becoming a Junior Agricultural Assistant.

Called up in 1941, he served as bugler, and later as drummer, in the F.M.S. Volunteer Force and was awarded the Efficiency Medal (Malaya) in 1949. It was due to his loyalty and devotion to duty that the pre-war records of the work of the Botanical Division were secreted and preserved by him during the Japanese occupation of Malaya, a service to the country of inestimable value. There were few activities of the Botanical Division in which Kassim had not from time to time taken an essential part and his wide basic knowledge of Malayan plants and agriculture was a valuable source of information. His versatility and energy led him into diverse activities: a competent mechanic he was a most useful handyman with apparatus, and as a patient teacher he was responsible for guiding many of the senior officers of the Department in their toils with the Malay language. Popular with all members of the Department, his cheerful presence will be sadly missed.

We extend to his widow and seven children our condolences in their sad bereavement.

Honours and Awards.

His Highness the Sultan of Trengganu has been pleased to award the Trengganu Meritorious Service Medal to Enche Jusoh bin Zain, Junior Agricultural Assistant.

Retirement of Mr. R. J. A. W. Lever.

Mr. R. J. A. W. Lever, B.Sc., D.I.C., A.I.C.T.A., F.L.S., Entomologist, retired from the Colonial Agricultural Service on the 30th August, 1956.

Mr. Lever joined the Department of Agriculture, British Solomon Islands, in 1930 and served there for seven years; he was then transferred to Fiji where he remained until he came to Malaya in 1946.

In the Solomons, as later in Fiji, Mr. Lever's work was largely related to the pests of coconut, but his versatility is evidenced by his contributions to the last published volume of the B.S.I.P. Agricultural Gazette which embraced such subjects as climatology, control of water hyacinth, crop meteorology, green manuring and fertiliser trials, analyses of coconut soils, continental uplift and denudation, Koster's Curse, and trade in reptile skins, as well as numerous entomological matters. A prolific writer in those days, he wrote 53 of the 69 articles published in that volume and subsequently wrote over 200 contributions to the Agricultural Journal of Fiji of which, for a number of years, he was editor.

During his early years in Malaya, Mr. Lever's activities were again largely aimed at coconut pests but more recently his attention was attracted to the entomological problems of pineapples, cacao, vegetables and stored products. On four occasions he acted as Senior Entomologist in charge of the Division, and it was in this capacity that he was serving when he left Malaya.

Mr. Lever's interests were by no means confined to his work; as a keen field naturalist he was a regular contributor to the Journal of the Malayan Nature Society and it may possibly have been his professional interest in the elimination of the noxious fauna which led him to the recreational pursuit of toxophily and marksmanship. Both Mr. and Mrs. Lever will be missed and we wish them a long and happy retirement.

L. N. H. L.

Promotion.

Enche Ahmad bin Jamal, Assistant Agricultural Officer, was promoted to Agricultural Development Officer with effect from the 1st June, 1956. Enche Ahmad is stationed in Pahang.

Appointments.

The following appointments have been made:—

Mr. K. Kanapathy, Chemist, to act as Senior Chemist with effect from the 5th July, 1956.

Mr. J. R. Milburn, Agricultural Officer, to act as State Agricultural Officer, Kedah and Perlis, with effect from the 11th July, 1956.

Mr. B. C. Balbernie, Agricultural Officer, to be Settlement Agricultural Officer, Penang, with effect from the 11th July, 1956.

Transfers.

The following transfers have been made:—

Mr. E. J. H. Berwick, Senior Agricultural Officer, to North Borneo with effect from the 11th July, 1956, on promotion to the post of Director of Agriculture in that territory.

Mr. G. I. M. Martin, Agricultural Officer, to the post of Agronomist, Kedah, with effect from the 9th August, 1956.

Enche Mohd. Noor bin Wahab, Agricultural Officer, to the post of Agricultural Officer, Selangor Coast (North), with effect from the 10th August, 1956.

Mr. M. J. Smith, Agricultural Officer, was transferred to the British North Borneo Agricultural Service with effect from the 6th October, 1956.

Leave.

The following officers have returned from leave:—

Mr. L. N. H. Larter, Assistant Director of Agriculture (Research), on the 23rd June, 1956.

Mr. R. G. Heath, Director of Agriculture, on the 13th September, 1956.

The following officers have proceeded on leave:—

Mr. A. R. McWalter, Chemist (Soils), on the 4th June, 1956.

Mr. D. S. Boyce, Agricultural Engineer, on the 17th June, 1956.

Mr. A. E. Billington, Senior Chemist, on the 5th July, 1956.

Mr. W. P. Panton, Geologist (Soil Survey), on the 15th July, 1956.

Mr. O. M. Lee, Principal, College of Agriculture, on the 11th August, 1956.

Mr. I. J. Wyatt, Entomologist, on the 9th September, 1956.

Mr. H. K. Ashby, Senior Agricultural Officer, on the 11th October, 1956.

As the printer's proofs of this issue of the Journal were being read, all officers of the Department were shocked when they heard of the brutal murder of Enche Mohd. Yunus bin Mohd. Din while carrying out his duties as Assistant Agricultural Officer, Malacca.

Che Yunus, whose personal characteristics were those of kindness, cheerfulness and tolerance, gave 32 years of loyal service to the Department in Malacca. Che Yunus was a friend to all. He always gave of his best in carrying out his work, and none will miss him more than the kampong folk of the Settlement to whom he gave devoted service.

His colleagues in the Department tender their deepest sympathy to his widow and family.

MARKET PRICES

April to June, 1956.

Rubber.—After being closed for four days the Singapore Rubber Market opened again on the 3rd April, when the noon price for R.S.S. No. 1 (f.o.b. in bales, buyer) stood at 89.25 cents per lb. The price gradually increased until it was 93.375 cents on the 14th April, but there was a decline after that and 86.375 cents was the price on the 30th. The average price for April worked out at 90.557 cents.

After reaching 89.5 cents on the 7th May, the price gradually dropped until it was only 73.875 on the 30th, the last day for business in May. The 80-cent mark was lost on the 24th, and the average for the month was 83.413. The market was closed on eight days in the month.

Although the average price for June dropped slightly to 83.288 cents, the price was 90 cents or more on four days. The highest price in June was 94 cents and the lowest 73.25 cents.

The prices quoted above are those reported by the Singapore Chamber of Commerce and they have been taken from the Monthly Statistical Bulletin of the Federation of Malaya.

The average prices paid for smallholders' rubber at three centres in the Federation of Malaya are given in Table I.

Table I.

Average Monthly Prices Paid by Local Dealers for Smallholders' Rubber, April to June, 1956.

(Dollars per pikul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	April	May	June	April	May	June	April	May	June
Smoked Sheet No. 1	98.53	90.50	89.66	98.42	91.12	93.02	—	—	—
Unsmoked Sheet	85.79	78.17	75.41	79.19	73.70	71.79	85.42	77.59	77.32
Scrap	43.97	41.74	37.33	56.83	54.41	50.61	30.42	27.74	26.88

This table has been compiled from statistics supplied by the Chief Statistician, Federation of Malaya.

Palm Oil.—The average prices realised in London for oil shipped by the Malayan Oil Palm Pool were, per ton:—April £80.75; May £81.5; and June £82.5.

Tea.—The Chief Statistician, Federation of Malaya, reports that 1,300,000 lb. of tea was produced during the quarter.

The average prices paid for Ceylon teas at the sale held in Colombo on the 26th June, 1956, and as reported in the Weekly Tea Market Report of the Colombo Brokers' Association, were, in rupees per lb.:—High Grown Teas (4,000 ft. and over) 2.00; Medium Grown Teas (2,000 to 3,999 ft.) 1.66; and Low Grown Teas (below 2,000 ft.) 1.75.

Derris.—The price of this commodity remained at $110 per pikul until the 30th April, when it rose to $120. On the 28th May the price returned to $110 and remained there till the 18th June, when it increased to $130 per pikul.

Table II.

Singapore Prices of Various Agricultural Products.

(Dollars per pikul)

Date	Copra, Sundried	Coconut oil *	Pepper. F.A.Q. Muntok white	Pepper. Gen. Muntok white	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1956								
3rd April -	29.00	45.25	120.00	130.00	50.00	12.75	17.75	16.50
9th April -	28.50	45.00	114.00	124.00	50.00	12.75	17.50	15.50
16th April -	28.50	47.00	110.00	120.00	50.00	12.62½	17.75	15.75
23rd April -	29.50	46.50	104.00	105.00	48.00	12.75	17.50	16.00
30th April -	29.25	48.50	100.00	110.00	48.00	12.75	17.50	15.50
7th May -	30.00	49.50	100.00	110.00	48.00	12.75	17.25	16.00
14th May -	29.25	48.50	97.00	107.00	48.00	12.75	17.25	16.00
22nd May -	28.75	47.75	92.00	102.00	48.00	12.75	17.50	16.00
28th May -	28.75	47.00	92.00	102.00	48.00	12.75	17.75	15.50
4th June -	28.75	44.00	86.50	96.50	48.00	12.75	17.75	16.00
11th June -	28.50	45.50	90.00	100.00	48.00	12.75	17.50	16.00
18th June -	27.75	42.00	97.00	107.00	48.00	12.75	17.50	16.00
25th June -	27.00	43.50	95.50	105.50	48.00	12.75	17.50	16.00

* F.O.B. in second-hand drums.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

FEDERATION OF MALAYA

PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1955	1956	1955	1956
January	4,093	3,712	1,124	1,038
February	3,997	3,697	1,081	1,013
March	4,854	4,520	1,300	1,229
April	4,630	4,105	1,221	1,079
May	4,152	4,364	1,076	1,096
June	5,135	5,263	1,256	1,310
July	4,802		1,238	
August	5,128		1,348	
September	5,073		1,269	
October	4,855		1,262	
November	4,952		1,348	
December	4,820		1,366	
Total	56,491	(25,661)	14,889	(6,765)

MALAYAN AGRICULTURAL EXPORTS,

JANUARY TO MARCH, 1956.

Product	Net Exports in Tons			
	Year 1954	Year 1955	Jan.-Mar., 1955	Jan.-Mar., 1956
Arecanuts	5,511	13,679	5,192	2,957
Coconuts, fresh † ‡	94,433 †	72,140 †	21,084 †	4,018 †
Coconut oil ‡	78,507	91,176	21,571	20,791
Copra ‡	67,472 *	75,076 *	19,964 *	21,196 *
Copra cake	40,520 *	56,404 *	10,112 *	16,417 *
Gambier, all kinds	134 *	66	92	35 *
Palm Oil	48,908	52,832	12,678	13,308
Pineapples, canned	21,533	27,756	6,631	5,979
Rubber ¶	585,081 §	637,463	158,057	161,135
Sago,—flour	27,980	23,053	5,776	4,743
Sago,—pearl	5,122	5,483	1,909	1,008
Sago,—raw	27,021 *	18,709 *	4,772 *	4,568 *
Tapioca,—flake	49	475	36	22
Tapioca,—flour	4,555 *	3,979 *	1,167 *	1,012 *
Tapioca,—pearl	7,865	5,470	1,404	1,179
Derris	16	13	2	2
‡ Copra equivalent	88,943	74,528	15,511	12,570

¶ production (Federation of Malaya). † hundreds in number. * net imports.

§ This figure includes an adjustment of + 2,090 tons shown in annual returns.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1955	1956	1955	1956	1955	1956
January	29,260	32,515	26,033	26,428	55,293	58,943
February	28,497	27,503	21,928	23,848	50,425	51,351
March	27,465	28,408	24,874	22,433	52,339	50,841
April	24,155	26,591	20,415	21,647	44,570	48,238
May	27,355	23,389	22,331	19,703	49,686	43,092
June	27,497	29,409	22,841	23,109	50,338	52,518
July	30,238		25,647		55,885	
August	30,650		23,571		54,221	
September	31,274		24,764		56,038	
October	30,724		23,960		54,684	
November	30,174		21,743		51,917	
December	34,893		27,174		62,067	
Total	352,182	(167,815)	285,281	(137,168)	637,463	(304,983)
Total 1954	344,851		240,230		585,081	

This Table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production						Coconut Oil Production		Copra Cake (Poonac) Manufactured	
	Estates (a)		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
January	2,674	2,728	4,297	7,808	6,971	10,536	5,528	8,247	3,561	5,197
February	2,797	2,713	8,366	8,457	11,163	11,170	7,753	7,369	4,808	4,612
March	2,975	3,032	7,726	6,463	10,701	9,495	7,368	8,459	4,603	5,242
April	3,021	2,878	7,478	7,188	10,499	10,066	6,165	7,916	3,934	4,855
May	3,619	2,813	7,630	11,015	11,249	13,828	7,399	8,729	4,580	5,434
June	3,748	3,333	10,534	9,457	14,282	12,790	8,017	9,193	5,128	5,731
July	3,955		12,311		16,266		8,538		5,400	
August	4,188		10,275		14,463		8,580		5,370	
September	3,745		9,511		13,256		9,259		5,749	
October	3,591		9,730		13,321		9,240		5,787	
November	2,850		8,486		11,336		9,059		5,758	
December	3,301		7,180		10,481		8,050		5,062	
Total	40,464	(17,497)	103,524	(50,388)	143,988	(67,885)	94,956	(49,913)	59,740	(31,071)

Notes:—1. The above Table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

(a) Includes copra equivalent of sales of fresh nuts by estates.

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, 1955-1956 Season.

State or Settlement (1)	TOTAL WET AND DRY PADI								
	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Production		
							Padi (5)		Rice (6)
	acres	per cent of total	acres	per cent of (2)	acres	per cent of (2)	gantangs ('000s)	per cent of total	tons
Perlis	46,580	5.4	1,410	3.0	45,170	97.0	10,177	3.8	16,030
Kedah	283,970	32.7	8,160	2.9	275,810	97.1	104,000	39.2	163,770
Kelantan	177,620	20.4	2,090	1.2	175,530	98.8	45,154	17.0	71,110
Trengganu	51,640	5.9	1,850	3.6	49,790	96.4	8,120	3.1	12,790
Penang and P. Wellesley	38,800	4.5	—	—	38,800	100.0	13,351	5.0	21,030
Perak	111,590	12.8	30	—	111,560	100.0	32,562	12.3	51,280
Selangor	46,150	5.3	—	—	46,150	100.0	20,518	7.7	32,310
Pahang	40,970	4.7	—	—	40,970	100.0	8,679	3.3	13,670
Negri Sembilan	31,770	3.6	840	2.6	30,930	97.4	9,660	3.7	15,210
Malacca	31,100	3.6	690	2.2	30,410	97.8	10,845	4.1	17,080
Johore	9,190	1.1	340	3.7	8,850	96.3	2,199	.8	3,460
Total, Main Crop	869,380	100.0	15,410	1.8	853,970	98.2	265,265	100.0	417,740
Off-Season Crop, 1955	6,500	—	240	3.7	6,260	96.3	1,479	—	2,330
Total 1955-1956 Season	875,880	—	15,650	1.8	860,230	98.2	266,744	—	420,070
Total 1954-1955 Season	891,090	—	24,000	2.7	867,090	97.3	260,727	—	410,590

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion rate: 635 gantangs padi = 1 ton rice (i.e. milling recovery 63 per cent).

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, 1955-1956 Season

WET PADI

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre			Production			Remarks (9)
							Padi (5)	per cent of main season average yield	Rice (6)	Padi (7)	per cent of total	Rice (8)	
	acres	per cent of total	acres	per cent of (2)	acres	per cent of (2)	gantangs		lb.	gantangs ('000s)		tons	
Perlis	46,460	5.7	1,410	3.0	45,050	97.0	225	70.5	792	10,155	4.0	15,990	1,410 acres failed due to drought.
Kedah	281,240	34.3	8,160	2.9	273,080	97.1	379	118.8	1,334	103,542	40.4	163,060	4,440 acres failed due to drought; 1,870 acres damaged by floods; 1,770 acres destroyed by pests; and 80 acres damaged by sea water.
Kelantan	143,440	17.5	1,760	1.2	141,680	98.8	272	85.3	957	38,472	15.0	60,590	1,680 acres failed due to late planting with very old seedlings; 80 acres failed due to drought.
Trengganu	43,170	5.3	1,830	4.2	41,340	95.8	170	53.3	598	7,044	2.7	11,090	1,830 acres failed because of the dry weather experienced in the middle of 1955.
Penang and P. Wellesley	38,780	4.7	—	—	38,780	100.0	344	107.8	1,211	13,346	5.2	21,020	
Perak	107,940	13.2	30	—	107,910	100.0	296	92.8	1,042	31,969	12.5	50,340	30 acres failed due to drought.
Selangor	46,120	5.6	—	—	46,120	100.0	445	139.5	1,566	20,515	8.0	32,310	
Pahang	39,710	4.9	—	—	39,710	100.0	213	66.8	750	8,440	3.3	13,290	
N. Sembilan	31,710	3.9	840	2.6	30,870	97.4	313	98.1	1,102	9,658	3.8	15,210	840 acres not harvested due to very late planting, pest damage and shortage of water during the growing period.
Malacca	31,090	3.8	690	2.2	30,400	97.8	357	111.9	1,257	10,844	4.2	17,080	360 acres damaged by flood; 140 acres destroyed by pests; 180 acres yielded empty grains; and 10 acres failed due to shortage of water.
Johore	9,190	1.1	340	3.7	8,850	96.3	249	78.1	876	2,199	.9	3,460	290 acres failed due to drought; 30 acres was damaged by rats; and 20 acres was not harvested due to neglect.
Total, Main Crop	818,850	100.0	15,060	1.8	803,790	98.2	319	100.0	1,123	256,184	100.0	403,440	
Off-Season Crop	6,360	—	240	3.8	6,120	96.2	239	74.9	841	1,463	—	2,300	210 acres abandoned due to lack of irrigation; 30 acres destroyed by pests.
Total, 1955-1956	825,210	—	15,300	1.9	809,910	98.1	318	99.7	1,119	257,647	—	405,740	
Total, 1954-1955	842,990	—	23,660	2.8	819,330	97.2	309	100.0	1,088	253,082	—	398,560	

Acreage to nearest 10 acres.
Rice production to nearest 10 tons.
Conversion rate: 635 gantangs padi = 1 ton rice (i.e. milling recovery 63 per cent).

FEDERATION OF MALAYA RICE STATISTICS.

Summary of Acreages and Production, 1955-1956 Season

DRY PADI

State or Settlement (1)	Area Planted (2)		Area Destroyed (3)		Area Harvested (4)		Average Yield per Acre			Production			Remarks (9)
							Padi (5)	per cent of main season average yield	Rice (6)	Padi (7)	per cent of total	Rice (8)	
	acres	per cent of total	acres	per cent of (2)	acres	per cent of (2)	gantangs		lb.	gantangs ('000s)		tons	
Perlis	120	.2	—	—	120	100.0	180	99.4	634	22	.2	40	
Kedah	2,730	5.4	—	—	2,730	100.0	168	92.8	591	458	5.1	710	
Kelantan	34,180	67.7	330	1.0	33,850	99.0	197	108.8	693	6,682	73.6	10,520	330 acres destroyed by wild pig, elephants and rats.
Trengganu	8,470	16.8	20	.2	8,450	99.8	127	70.2	447	1,076	11.9	1,700	20 acres not harvested due to drought, floods and pest damage.
Penang and P. Wellesley	20	—	—	—	20	100.0	250	138.1	880	5	.1	10	
Perak	3,650	7.2	—	—	3,650	100.0	163	90.1	574	593	6.5	940	
Selangor	30	.1	—	—	30	100.0	90	49.7	317	3	—	—	
Pahang	1,260	2.5	—	—	1,260	100.0	189	104.4	665	239	2.6	380	
N. Sembilan	60	.1	—	—	60	100.0	30	16.6	106	2	—	—	
Malacca	10	—	—	—	10	100.0	118	65.2	415	1	—	—	
Johore	—	—	—	—	—	—	—	—	—	—	—	—	
Total, Main Crop	50,530	100.0	350	.7	50,180	99.3	181	100.0	637	9,081	100.0	14,300	
Off-Season Crop, 1955	140	—	—	—	140	100.0	115	63.5	405	16	—	30	
Total, 1955-1956	50,670	—	350	.7	50,320	99.3	181	100.0	637	9,097	—	14,330	
Total, 1954-1955	48,100	—	340	.7	47,760	99.3	160	99.4	563	7,645	—	12,030	

Acreage to nearest 10 acres.

Rice production to nearest 10 tons.

Conversion rate: 635 gantangs padi = 1 ton rice (i.e. milling recovery 63 per cent).

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1956.

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										in.	mm.	in.						hr.	hr.	
Ipoh, Perak	92.6	73.8	83.2	95.3	71.3	87.8	76.5			8.35	212.1	3.89	18	15	7			194.85	6.49	
Kuala Lumpur, Selangor	90.2	73.8	82.0	93.8	70.9	83.5	76.1			5.41	137.4	1.92	20	14	8	6				
Sitiawan, Perak	89.6	73.1	81.3	93.5	71.1	84.9	75.5	85.2	85.7	3.85	97.8	1.16	12	11	2	2		196.25	6.54	
Kuantan, Pahang	89.7	72.3	81.0	92.6	68.0	84.4	75.0	83.0		12.52	318.0	3.15	15	12	12	6		197.50	6.58	
Bayan Lepas, Penang	88.4	74.7	81.5	90.9	72.3	86.0	78.6			4.55	115.6	1.60	20	14	3			203.30	6.78	
Malacca	88.6	73.8	81.2	91.3	71.5	84.3	75.9			2.80	71.1	1.39	13	10	1		1	197.65	6.59	
Mersing, Johore	88.5	72.0	80.3	91.0	69.6	81.4	74.2			6.89	175.0	1.74	14	12	1		1	210.95	7.03	
Alor Star, Kedah	91.0	74.4	82.7	94.4	72.1	87.4	77.0			6.66	169.2	1.66	21	16	6			233.20	7.77	
Kota Bharu, Kelantan	89.7	74.3	82.0	92.1	69.8	86.6	77.1	88.5	87.8	6.05	153.7	1.78	13	9		1		259.45	8.65	
K. Trengganu, Trengganu	89.0	73.4	81.2	90.5	69.4	87.0	75.0			3.42	86.9	1.21	11	9				247.65	8.25	
Singapore	89.0	74.9	81.9	92.2	72.1	84.0	77.2			1.74	44.2	0.74	11	6	3	1		159.85	5.33	
HILL STATION																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.4	56.5	65.5	78.5	50.0	70.2	61.8			16.94	430.3	2.24	23	21				131.45	4.38	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1956.

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes				At 1 foot	At 4 feet	Total		Most in a day	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	°F	°F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more			
										in.	mm.	in.						hr.	hr.	
Ipoh, Perak	92.4	74.2	83.3	94.9	71.4	82.9	77.2			8.32	211.3	2.14	14	12	8			178.25	5.75	
Kuala Lumpur, Selangor	90.8	73.7	82.3	95.3	71.0	83.0	76.1			5.85	148.6	1.71	14	11	6					
Sitiawan, Perak	90.3	73.7	82.0	94.2	70.9	80.9	75.9	85.5	86.1	1.96	49.8	0.55	12	8	1			186.50	6.02	
Kuantan, Pahang	88.9	72.7	80.8	92.1	69.7	79.6	75.8	83.3		6.57	166.9	1.89	16	15	10	4		168.25	5.43	
Bayan Lepas, Penang	88.1	74.6	81.3	90.4	71.9	82.8	77.0			6.26	159.0	1.72	16	12	5			178.80	5.77	
Malacca	88.4	73.1	80.7	91.1	71.0	84.4	75.5			9.96	253.0	2.29	13	12		1		191.95	6.19	
Mersing, Johore	87.9	72.1	80.0	92.4	70.2	80.6	74.2			7.78	197.6	1.95	16	15	1			211.35	6.82	
Alor Star, Kedah	89.4	74.6	82.0	93.0	72.0	84.6	77.7			12.77	324.4	3.40	19	16	5			174.75	5.64	
Kota Bharu, Kelantan	88.1	74.7	81.4	90.5	71.6	83.3	78.0	85.9	87.1	6.76	171.7	1.74	14	13	9			168.35	5.43	
K. Trengganu, Trengganu	87.6	73.7	80.7	90.5	70.4	84.0	75.9			5.94	150.9	1.78	20	16	1			157.15	5.07	
Singapore	87.5	74.9	81.2	92.6	71.2	82.0	77.0			8.97	227.8	1.84	17	14	8	1		153.70	4.96	
HILL STATION																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.5	57.8	66.1	79.4	53.0	67.4	61.0			9.97	253.2	2.70	20	19				119.95	3.87	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1956.

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										in.	mm.	in.						hr.	hr.	
Ipoh, Perak	91.4	72.3	81.9	95.2	69.2	82.9	76.2			3.95	100.3	1.32	11	8	3			200.35	6.68	
Kuala Lumpur, Selangor	90.1	72.8	81.5	94.3	70.5	80.4	75.1			6.80	172.7	1.24	16	15	16	4				
Sitiawan, Perak	90.2	72.5	81.3	94.5	70.0	86.2	75.1	84.6	85.9	2.39	60.7	1.68	8	6	3	2		212.20	7.07	
Kuantan, Pahang	89.6	72.2	80.9	93.7	69.2	84.5	75.1	83.7		2.62	66.5	0.97	10	8	1	3		201.85	6.73	
Bayan Lepas, Penang	87.3	73.3	80.3	90.3	70.7	82.3	76.4			5.80	147.3	1.05	16	15	3			184.35	6.15	
Malacca	88.4	72.5	80.5	91.5	70.5	83.1	74.4			2.34	59.4	0.75	13	8	1	1		228.30	7.61	
Mersing, Johore	88.4	71.4	79.9	92.9	69.4	83.0	75.2			1.88	47.8	0.57	10	8	1			226.00	7.53	
Alor Star, Kedah	88.3	73.8	81.1	91.8	70.7	81.3	76.6			8.04	204.2	1.24	19	16	7	1		198.50	6.62	
Kota Bharu, Kelantan	88.2	74.4	81.3	93.0	71.0	82.7	77.5	84.6	85.9	7.71	195.8	2.55	9	9	6			195.70	6.52	
K. Trengganu, Trengganu	87.6	73.1	80.3	90.7	71.2	82.5	75.7			2.40	61.0	0.79	9	9	1			211.50	7.05	
Singapore	87.8	74.5	81.1	91.0	72.0	84.7	78.1			5.65	143.5	2.55	9	7	6	3		181.85	6.06	
HILL STATION																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	73.0	56.3	64.7	77.5	50.5	67.0	65.5			9.73	247.1	1.69	13	13				156.70	5.22	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1956.

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall							Bright Sunshine		
	Means of			Absolute Extremes								Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										in.	mm.	in.						hr.	hr.	
Ipoh, Perak	91.1	72.1	81.6	95.0	69.0	83.8	74.8			7.64	194.1	1.47	13	13	5			201.35	6.49	
Kuala Lumpur, Selangor	89.1	71.9	80.0	92.4	69.0	83.2	74.7			3.32	84.3	0.96	14	12	5	3				
Sitiawan, Perak	89.9	72.0	80.9	94.1	69.0	85.0	75.7	84.3	85.7	3.37	85.6	1.11	11	9	3			197.75	6.38	
Kuantan, Pahang	89.7	71.0	80.3	93.1	68.3	82.2	75.8	83.2		2.19	55.6	0.89	14	8	4	2		192.20	6.20	
Bayan Lepas, Penang	87.1	73.5	80.3	89.2	70.7	83.2	75.5			12.23	310.6	3.17	18	15	6			201.70	6.51	
Malacca	87.2	71.9	79.5	90.2	69.3	83.8	74.3			5.34	135.6	1.18	13	12	3			209.60	6.76	
Mersing, Johore	88.0	70.9	79.5	90.8	67.3	81.7	73.0			4.88	124.0	1.75	13	12			2	201.00	6.48	
Alor Star, Kedah	88.0	73.9	80.9	91.2	71.0	83.6	77.0			5.75	146.1	1.85	16	13	4			208.20	6.72	
Kota Bharu, Kelantan	88.6	74.0	81.3	92.0	70.3	83.1	76.4	85.7	86.3	4.85	133.2	2.93	11	9	4			200.30	6.46	
K. Trengganu, Trengganu	87.3	73.1	80.2	90.8	69.7	81.0	75.2			3.69	93.7	0.93	14	12	1			182.75	5.89	
Singapore	86.6	73.5	80.1	89.6	70.2	81.8	75.5			7.52	191.0	1.29	16	14	7	1		177.60	5.73	
HILL STATION																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	73.4	61.0	67.2	76.5	53.0	69.0	65.8			10.05	255.3	2.03	13	12				160.45	5.18	

Compiled from Returns supplied by the Malayan Meteorological Service.